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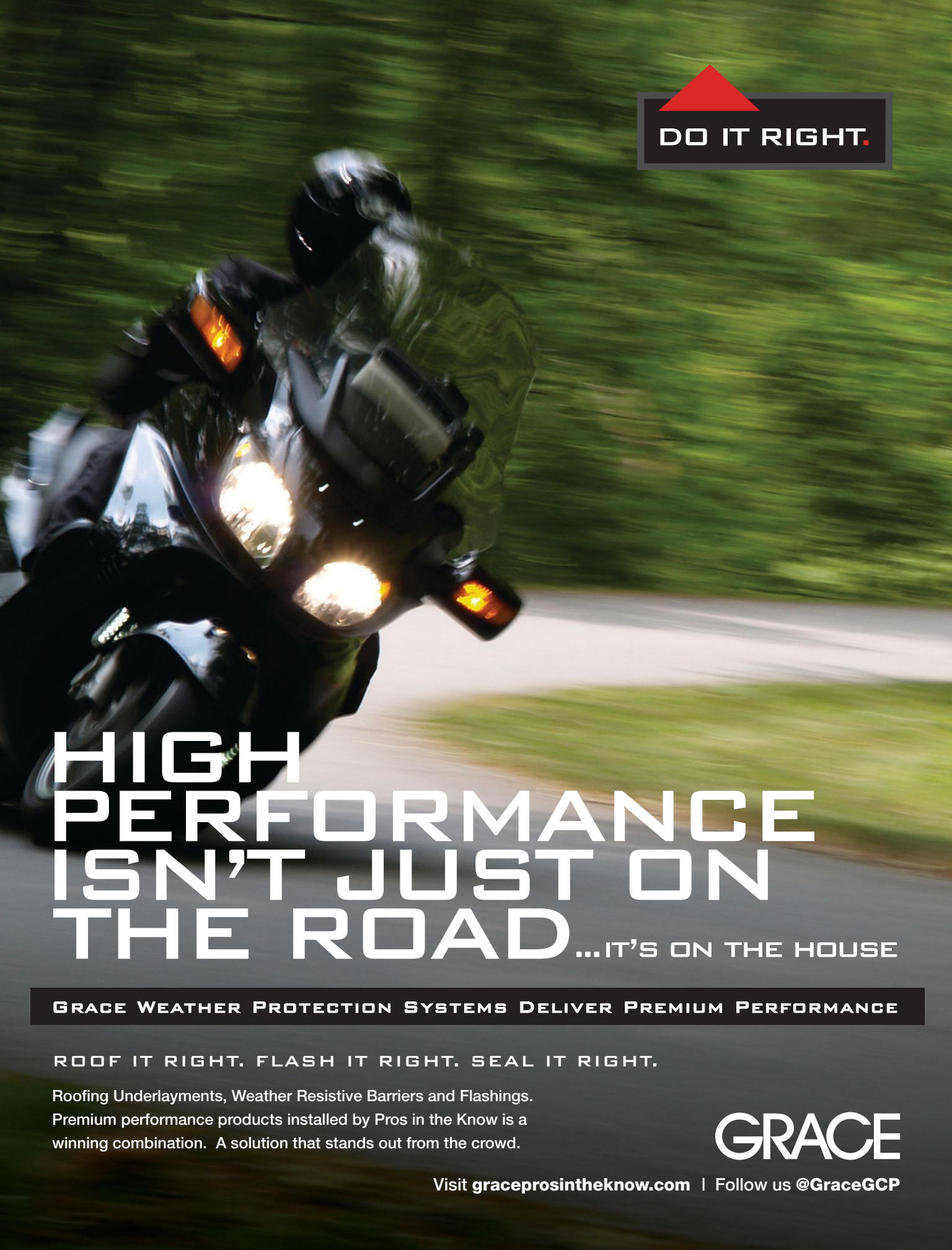
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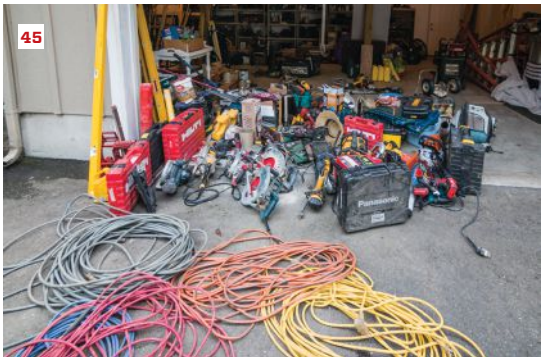

On the cover: Tim Houldcroft cuts Foamglas footing insulation with a mason's trowel on a job with Auburndale Builders in Wayland, Mass. Photo by Ted Cushman

FEATURES

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"WORKING WITH THICK LAYERS OF EXTERIOR FOAM," BY CLAYTON DEKORNE (MAY/15)

Bob Dorazio: Instead of sheathing corners (only) and then furring with thin foam, we used another way to achieve an in-plane wall surface before sheathing with foam. We used to take OSB scraps and rip them on a table saw to 1 ½ inches or so and fur the unsheathed studs so they were flush with the sheathing. This approach seemed to pencil out at a lower cost compared with sheathing the entire house. These days, though, sheathing the entire house is more common.

"WEATHER BARRIER UPDATE: GOOD, BETTER, AND BEST," BY MATT RISINGER (MAY/15)

Robin McC (online, 5/11/15): I know companies test products to simulate 50 years, but I have a hard time believing that tape I apply to anything today will still be adhered in 50 years. That doesn't mean I don't use new products, it just means I don't think we have found any holy grails.

David Landry (online, 5/11/15): I am a little concerned about your comments regarding the UT [University of Texas] testing of the thinner liquid-applied WRBs. These products, such as Sto-Guard and Prosoco Cat-5, are not designed for UV exposure for longer than six months, and I would expect them to be degraded after nearly two years in the Texas sun. Product longevity should be evaluated according to the designed specs. No?

Matt Risinger responds: I agree that UV damage is a major issue for these WRBs and that this "torture" test isn't necessarily an indicator for performance. I am merely suggesting that we evaluate critically the waterproofing products we use, as they can't easily be inspected and they need to last for decades or even generations without failure.

Mr. Common Sense (online, 5/10/15): We just re-sided a 60-year-old house that had 1x8 sub-sheathing covered with 30-pound tar paper and no water damage found. How far we have come!

Conrad vonBlankenburg (online, 5/13/15): I am always amused by the "newest" product! Any of us who have worked on older buildings (1800s) know that the primary barrier does not need a secondary barrier. All of the buildings from the 1890s I have worked on had redwood shiplap siding nailed directly to the studs. They had very little decay unless some bonehead had piled soil against the wall. Window sills lapped over the siding with a rabbet on the bottom. The carpenter borrowed methods from boat builders to prevent rain from entering the building. I have always used two layers of 15-lb. felt under siding or stucco for the primary barrier, on thousands of buildings. This helps keep wind-driven rain from finding its way into the structure. Attempting to seal the building from air circulation is a fool's errand. The large accumulation of moisture "inside" the living space has to get out or the building will rot.

Matt Risinger responds: In response to Conrad and Mr. Common Sense: I agree that tar paper has worked well for generations. But remember that those older homes tend to have solid lumber sheathing, full 2x4 studs, and no insulation. They can "leak" without causing problems. Newer homes tend to be much more moisture sensitive and have very little capacity to "leak" without failures occurring. Thanks for reading and commenting.

"INSTALLING DRYWALL OVER RIGID FOAM," BY MYRON FERGUSON (OCT/12)

Mark Attard (online, 5/31/15): I would caution against installing rigid foam on the inside of a building without first assessing the rest of the roof assembly and considering the climate zone. Applying foam on the inside of a building does not address the issue of thermal bridging. Because roof joists offer little in the way of thermal resistance, cold air will penetrate into your insulation cavity. Once it hits the warm air of the cavity, it will condense. With no way for the moisture to escape, you are setting yourself up for a disaster of mold and rot.

Pete Goldie (online, 5/31/15): I, too, strongly recommend looking at the possibility of condensation forming between the rigid insulation on the roof sheathing. In my own house, I never had a moisture problem in the attic. But adding 3 inches of poly-iso suddenly made the north-faced roof saturated enough to drip through cracks and joints. Fortunately, I had not installed the drywall yet, so I removed the rigid, added six eyebrow roof vents, and furred out the rigid to provide circulation between the sheathing and insulation. This happened in the mild climate of San Francisco. By the way, the south-facing side remained dry as a bone.

Q I'm building a house with 12-inch walls. Is it better to install windows on the inside or the outside plane of the walls?

A Steven Baczek, a residential architect from Reading, Mass., who specializes in designing durable, low-energy homes, responds: The answer is that the best window is the one that's installed properly. When you are installing windows in thick walls, a number of questions—regarding aesthetics, performance, and durability—play a role in deciding where the window should be placed in the wall system.

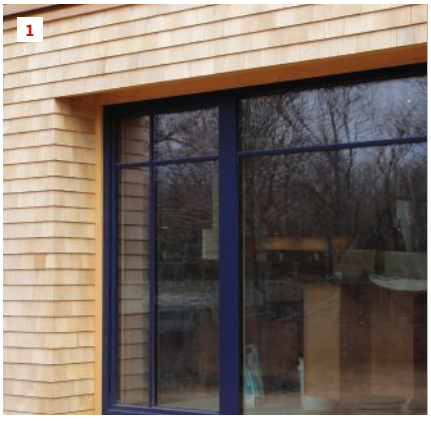
The aesthetics are determined in part by the size of the window, but the thickness of the wall can make the choice even more critical. Moving the window away from the outside of the wall requires exterior jamb extensions made from either the trim material or exterior siding **(1)**. The farther inward the window moves, the more you accentuate the thickness of the wall.

Performance. Next you need to consider comfort and the thermal performance of the window. From a thermal perspective, a window really should be placed in the center third of the opening to put it in the middle of the wall's "R" value—not too cold, not too warm, but just right.

Placing the window in the outer third of the wall puts the window in the colder part of the opening, and you risk creating a microclimate in the window pocket, especially with smaller openings **(2)**. This microclimate carries the risk of getting cold enough for moisture to condense on the glass (a good reason for triple glazing). A colder glass surface also makes you feel colder when you're standing next to it. As your body radiates heat toward the colder glass surface, you feel chilly.

From a durability standpoint, window placement is more complicated, because of the issues of water management. When exterior insulation is applied over the wall sheathing, I almost always align the window with the drainage plane/weather barrier to minimize the number of horizontal elements in the continuous weather-barrier system. Quick-draining, vertical scenarios make for a much more durable system. It's not to say that an inward window, with an assumed weather barrier on the outer surface of the wall, can't work, it's just that you need to heighten your water-management awareness to account for the additional risk.

When I place a window in the center third of the wall **(3)**, I need to create a system to drain water back out to the drainage plane on the exterior surface. I usually set the window on a piece of 5/4 or 1x3 to provide a "sill dam" that is my last defense for water intrusion. Then I install a tapered piece of wood such as cedar clapboard over the sill section of the opening and flash over the tapered board, running the sill flashing up and over the sill dam, and up the jambs at least 6 inches. As a result, I horizontally connect the window (part of my drainage plane) to the exterior sheathing (another part of my drainage plane), and the "innie" window is now integrated with the drainage system.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Photos: Steven Baczek

Q At a client's home, one of the interior doors always swings open by itself unless it is latched completely. The door meets the stop evenly. How can I best remedy the problem?

A Gary Katz, owner of Katz Road Show, editor of *ThisIsCarpentry*, and a presenter at JLC Live, responds: When a door swings open or closes by itself, most carpenters refer to it as a "ghost" door. The cause for the phenomenon is simple: The door jamb is out of plumb.

The jamb may have been installed in an out-of-plumb wall, but that's not always the case. In my own home, I installed a door that closed by itself even though the wall was perfectly plumb. I'd made that door in my shop from old Douglas fir 2x6s. The door was beautiful, but the wood had so much twist in it that I had to install the jamb out of plumb so the door would hang flush with the jamb. I fixed that "ghost" door with an old, tried-and-true technique—I bent the hinge pins.

The bent pins cause the leaves of the hinge to bind slightly, which stops the door from swinging on its own. In my experience, you can stop most ghost doors from swinging by bending just one pin. But my door jamb was so out of plumb that I needed to bend both hinge pins—and I had to bend them a *lot*.

It's easy to bend a hinge pin. Just set the pin on a hard surface—a concrete basement slab works great. You can put a piece of 1-by under one end of the pin, then smack the pin with a hammer right in the middle to bend it a little.

Put the pin back in the hinge and see if the door stops swinging. If the door still swings, bend the other pin (or pins), too. If the door still swings (like mine did), bend both pins even more!

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BY GREG BURNET

Preassembling Exterior Trim

In my article "Installing Engineered Horizontal Siding" (May/15), I wrote that preassembling exterior trim details can streamline the siding process. It can also dramatically improve the quality of the installations. We fabricate door and window trim, corner boards, and sometimes soffits and cornices safely on the ground or in the shop and then install them in one piece.

WINDOW AND DOOR TRIM

Many flanged or block-frame windows have a minimalist "modern" look when installed, and we often dress them up with additional trim. I first measure all but the biggest windows that we'll be trimming (larger windows are easier to trim on site), and I develop a cut list for each unit.

Because there are often many windows of a similar size on a job, I group them together and cut all the components at the same time. A trim package for a typical window consists of a sill nosing or extension, two vertical legs, a head, and an apron. If the window is plumb, level, and square, then the sill and the header trim are one length, and the two legs are another, so I need to calculate only two lengths for each window.

With a cut list in hand, I set the repetitive stop on the miter-saw stand to the appropriate position and cut all the components to length **(1)**. To minimize confusion and error, I label each piece as it comes off the saw, before prepping the pieces for assembly.

POCKET-SCREW JOINERY

For preassembling trim packages for doors and windows, using pocket screws is the fastest and strongest way to join the pieces. Pocket-screwed joints also stay tight in almost any environment. There are several

Photos: Sue Burnet


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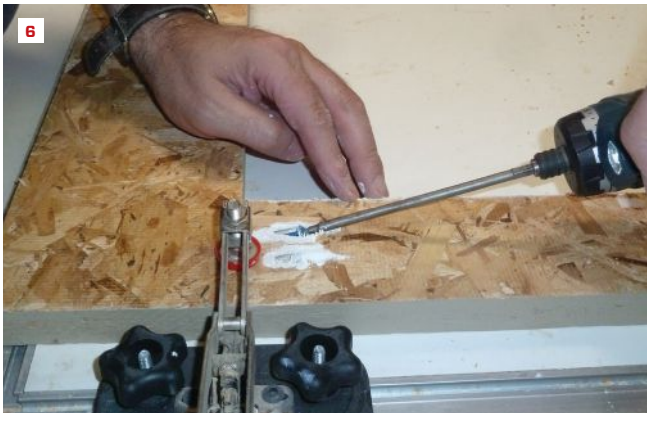
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commercially available jigs for drilling the screw holes. We use a Kreg jig, which places the screws at a 15-degree angle to the face of the board. The jig clamps onto the back surface of the material being fastened and a specialized stepped drill bit with a stop collar creates the holes **(2)**. We usually place one screw every 2 to 3 inches.

Before the trim is assembled, it's important to seal any cut ends with quick-drying primer **(3)**. We also seal the screw holes **(4)**. Without sealer, exposed fibers can allow moisture to migrate into the material, which can lead to failure of the joint or of the material itself.

We place the pieces for each frame face down on an assembly table and put a bead of sealant in the joints **(5)**. We clamp each corner firmly to the table to keep the outer faces flush and to prevent the pieces from moving while we drive the screws.

The screws themselves are designed specifically for pocket-screw joinery; they have washer heads and self-tapping threads to minimize splitting and to draw the pieces together. We use fine-thread screws with dense materials like hardwood, and coarse-thread screws with softer woods and most engineered materials used for trim. (For more about fastening PVC, see "Fastening and Finishing PVC Trim," 09/14.)

We drive the screws using a long square-head driver bit. We've found that a cordless drill with clutch settings is the best tool for driving the screws **(6)**; impact drivers can strip the threads out of the wood or overdrive the screws. We use corrosion-resistant screws for all exterior applications.

CORNER BOARDS

Corner boards can be built more neatly and efficiently on the ground. This is especially true for multistory buildings where the walls are not always in the same plane from one floor to the next. Instead of wrestling with individual pieces, trying to get the joints tight, we preassemble entire corners on our cutting table and install them as one piece. Full-length corner assemblies bridge any framing irregularities and allow us to make slight adjustments to the corners of a building, if necessary.

The most common method for building outside corners is a butt assembly, where the two corner boards are fastened to each other along one edge to form a right angle. To make the corners the same dimension on both sides, we first set the blade at a slight angle (2 or 3 degrees) **(7)** to create a tighter-fitting joint; and then we rip down—by the thickness of the material we're using—the board that will be less visible **(8)**. For example, to make 5/4 by 5 ½-inch corners, we rip the

abutting piece to a width of 4 ½ inches. When the corner is assembled and installed, it will read the same on both sides of the building **(9)**.

Again, we seal all cut edges with primer before assembling the pieces. Then we run a bead of sealant along the long edge of the ripped piece **(10)** and bring the two sides together, clamping them as needed. We drill holes for 8d stainless steel box nails **(11)**, which we then drive by hand **(12)**. We avoid pneumatic nailers when fastening corners; the dense, engineered material that we use can cause gun-driven nails to drift—and often to exit through the face of the trim.

Another corner detail we sometimes use consists of two boards of equal width. But rather than the two boards overlapping, they just touch each other at their back corners and a piece of ¾-inch-diameter quarter-round molding fills in the space between the two boards. This type of corner can be installed piece-by-piece or preassembled and installed as a single unit. Preassembly is relatively straightforward, with the two boards joined by trim screws or finish nails driven through the quarter-round molding and into the mating corners. However, the completed corner tends to be a bit delicate.

Regardless of the corner detail we choose, we always steer clear of bevel rips, miters, and scarf joints in the boards. These joints are likely to open and provide a path for water to enter the assembly or to make its way behind the trim where it can become trapped. Instead, we opt for butt joints on all trim that isn't profiled. Unlike solid wood, most engineered material has no end grain, so exposing the core of the material is fine, as long as it's properly sealed.

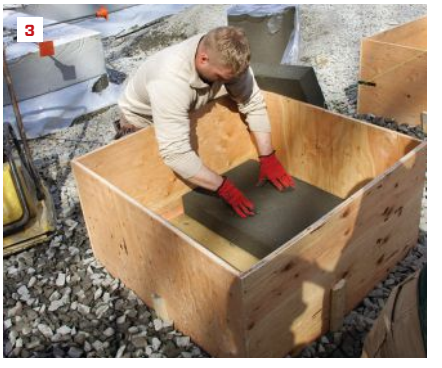
INSTALLATION

Once the preassembly is done, we begin the installation, starting with corners and window trim. Because the fasteners are exposed, we always use 8d stainless-steel ring-shank nails. The stainless fasteners minimize the potential for rust streaks and bleeding under finishes.

We nail corner boards in place every 12 inches, staggering the nails between sides. Window trim is fastened with similar spacing, although we take care not to drive nails through the fins on flanged windows, which could restrict the window's movement (particularly on vinyl units) and even cause the frame to crack in colder weather.

For inside corners, we usually use square rips of 5/4 stock. We seat them tightly between the intersecting walls and nail them every 12 inches or so. As with siding, we always pay close attention to the depth the nails are driven. It's better to underdrive nails and finish them off with a hammer than drive them too deep, which reduces their holding power.

Greg Burnet owns Chicago Window and Door Solutions and is a presenter at JLC Live.



Insulated Footings for a High-Performance Home

BY TED CUSHMAN

By code, occupied-basement walls in cold climates must be insulated. For most builders, it's less common to insulate beneath the concrete footings—which typically are buried deep enough to rest below the frostline—for those walls. But to eke out a little more efficiency, some high-performance builders surround the whole building with insulation—even under footings and basement slabs.

That's the strategy Auburndale Homes employed in Wayland, Mass., in the high-end Passive House project shown here. Passive House consultant Michael Hindle specced out the insulating detail using Pittsburgh Corning Foamglas and Roxul rock wool, after succeeding with the same approach on another building in mountainous western Maryland (where, surprisingly, because of the altitude and distance from the coast, January winter temperatures are actually a few degrees colder than in Boston).

Hindle explained his reasoning to *JLC* in a phone interview: "The footing is not exposed to weather, but it sure is exposed to cold temperatures," he said. Ground temperatures vary with depth as well as seasonally, but in a New England winter, temperatures below the frostline average about 50°F. "50°F is about equal to the average outdoor air temperature of your cold shoulder months, when you do have a heating load," Hindle pointed out. "So there is a heating load associated with foundation ground contact."

Ground temperatures lag outdoor temperatures by about five weeks at a 5-foot depth and by about nine weeks at a 12-foot depth, according to consultant Marc Rosenbaum. "So," said Hindle, "you could have cold temperatures in your basement right into June. In modeling, I've found that when I have a lot of ground exposure, I have heating loads for a lot longer than I would have thought. And when I insulate ground-contact elements well, that load goes away."

Even if you're not trying to hit a precise energy consumption limit, said Hindle, "you probably still want to avoid condensation, and that means knowing the dew point of your interior air and making sure the surface temperatures in the corners of your basement don't get

too cold. And in this case, I can tell you that if you were to pull out that footing insulation, that edge of that slab would be cold."

Some builders use high-density expanded polystyrene (EPS) or extruded polystyrene (XPS) to insulate foundations. But for environmental reasons, Hindle has been searching for a way to avoid plastic. For the Wayland job, he specified Foamglas insulation (made from 100% glass) under the footings, and rock wool under the slab. Handling and installing those materials fell to Auburndale project manager Mike Dutra and his crew.

The entire house sits on an 18-inch base of "trap rock"—large, angular crushed stone that compacts well and has excellent bearing strength. But Foamglas, while it won't crush under a concrete wall, is brittle and needs a smooth, flat surface to support it. So on top of the trap rock, Dutra's crew shoveled on "crusher run"—a graded mix of small gravel and fine dust that compacts well **(1)**.

Actually, Dutra said, he would have preferred to use stone dust instead of crusher run. But in February, when the foundation work started, every pile of stone dust in Massachusetts was frozen solid. The drawback to the crusher run was that, while smoother than trap rock, it still had some sharp gravel that could have damaged the Foamglas. So the crew added a thin layer of mason's sand for protection **(2)**, then set the pieces of Foamglas into the 2-foot-deep forms **(3)**.

After learning that Foamglas comes in 18-inch by 36-inch blocks 6 inches thick, Dutra asked architect Donald Grose to redraw the home's perimeter footings at 3 feet wide instead of 4. Said Dutra, "Foamglas is expensive and you don't want to waste it. We ended up with just two trash bags of scrap." Where pieces did need cutting, said Dutra, the crew started out using a sharp-pointed drywall "jab saw," as suggested by Pittsburgh Corning. But the crew discovered that a sharp mason's trowel worked even better for making fast, accurate cuts **(4)**. (By the way, use caution: Workers cutting Foamglas should wear respirators because the fine glass particles carry a risk of causing lung damage.)

When you pour concrete on top of Foamglas, a plastic "slip sheet" is required to isolate the rough surface of the glass from the wet concrete **(6)**. Without this separation, the concrete will bite into the glass, and the glass is likely to fracture when the concrete shrinks or expands, either during curing or in service. But other than that, no special precautions are required when placing concrete **(7)**.

Once the concrete had set, the crew applied a capillary break of Mel-Rol waterproofing membrane from W. R. Meadows and sealed the rebar penetrations with Meadows' Pointing Mastic **(8)** as well as Siga Wigluv tape. After stripping the footing forms, the crew placed Roxul rock wool against the sides of the footings **(9)**, using construction adhesive to hold the Roxul batts in place until gravel could be placed to hold the insulation permanently.

Ted Cushman is a senior editor at JLC.

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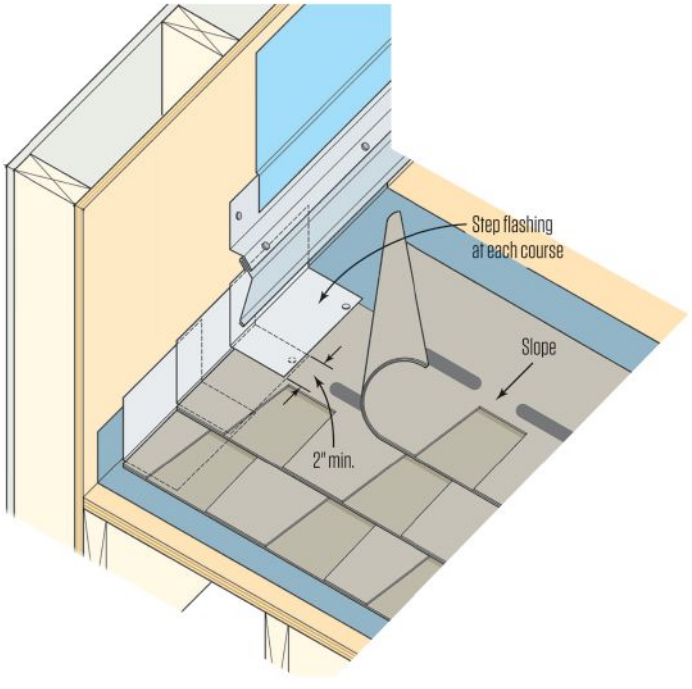
BY GLENN MATHEWSON

Step Flashing vs. Continuous Flashing

Tried-and-True Step Flashing



While the building code now allows you to install continuous flashing along a sloped roof-to-wall intersection, the author cautions against it and instead advises sticking with the long-accepted practice of installing step flashing, as shown in the illustration above. This detail is taken from detail ASPH-12A of the NRCA Roofing Manual: Steep-Slope Roof Systems—2013.

The development of the International Codes is a continuous process, with each code volume being revised on a three-year cycle. Changes are submitted and approved and can then be reviewed in subsequent cycles. Controversial changes get people and the building industry thinking, which is what happened recently with the way code looks at sidewall flashing in asphalt-shingle installations.

STEP FLASHING THROUGH HISTORY

Step flashing has been required for asphalt shingles at roof-to-wall intersections as far back as the 1986 CABO. With this method, L-shaped pieces of metal that are a couple of inches longer than the shingle overlap are installed on top of each shingle adjacent to the sidewall, and the flashing is then laced into each course. Step flashing ensures that any water that migrates underneath a shingle will still end up on top of the flashing that is covering the shingle below. The water can then drain away safely.

In addition to the CABO reference, the requirement for step flashing at sidewalls appeared in the first edition of the International Residential Code (2000 IRC) and remained unchanged through the 2009 edition.

Every asphalt-roofing manufacturer's installation instructions that I have ever seen specify step flashing as the preferred way to flash the roof-to-wall juncture. And in section 905—which covers the installation of all roof coverings—of the 2015 IRC, the first sentence requires compliance with the code and the manufacturer's installation instructions. But things changed in 2012.

ENTER CONTINUOUS FLASHING

In the 2012 IRC, the section that covered sidewall flashing was much expanded, and for the first time, it included continuous flashing as an approved method for roof-to-sidewall flashing with asphalt shingles. Continuous flashing has always been used at a

The new provision allowing the use of continuous flashing at sidewalls is rather vague and provides very few installation details.

headwall (an intersecting wall at the top of a roof plane and perpendicular to the slope). In this case, continuous flashing is simply a single piece of flashing placed behind the exterior cladding and weather-resistive barrier on the wall and then extended out over the shingles. The flashing can be left exposed, or installers can adhere a "beauty strip" of asphalt-shingle material to the flashing to make it less visible from the ground.

NO CLEAR DIRECTIONS

To complicate matters, the new provision allowing the use of continuous flashing at sidewalls is rather vague and provides few installation details beyond the need for the vertical leg of the flashing to be at least 4 inches tall and for the flashing to divert water away from the side wall using some sort of kick-out flashing.

Installation details for continuous flashing are also missing from the asphalt-shingle manufacturers' installation instructions. After decades of sidewall step flashing being installed beneath the shingles, continuous flashing is most likely to be installed below the shingles as well. But some installers may assume that continuous flashing should be installed above the shingles, as is done for headwall flashing. The IRC offers nothing to clarify this issue.

Continuous flashing at sidewalls is standard practice for clay tile and slate shingles (see "Roofing With Tile," 06/15). In those applications, the continuous flashing installs under the roofing. Those roof coverings are meant to provide protection from bulk water movement only, with the expectation that moisture will find its way beneath the roofing and that the underlayment will provide the final protection.

Industry standards and manufacturer installation instructions for clay and slate also specify that the continuous sidewall flashing have a J-roll along the edge under the shingles and over the roof deck. The small roll along the long edge of the continuous flashing helps to ensure that water will flow down to the bot-

tom of the flashing and not migrate sideways and off the flashing.

This roll is effective for clay and slate roofing because those products are usually elevated on horizontal battens. Asphalt shingles, however, are not rigid like clay or slate, and a J-roll would likely telegraph a hump to the finished surface. Additionally, asphalt shingles would not protect the J-roll from getting flattened by someone walking on the roof. But the IRC does not mention a J-roll along the edge of continuous flashing in an asphalt-shingle application.

REGIONAL APPLICATIONS

Based on anecdotal evidence I've gathered, continuous flashing is used regularly only in drier regions of the country, such as the desert Southwest. Mike Guertin touches on continuous flashing in his roofing demos for JLC Live, and his insights for installing continuous flashing are provided in "Installing Continuous Flashing," on page 26.

After all this information was discussed (with plenty of opposition) in the 2012 hearings and again in 2015, the measure was still approved. But because this new subject is not clearly spelled out in the code, I would encourage you to do a little homework before trying to change the decades-long practice of using step flashing with asphalt shingles. Review the installation instructions of the product you are installing and perhaps contact a technical representative at the manufacturer for guidance for an alternative installation method that uses continuous flashing. Then follow whatever details the manufacturer provides.

Also I'd review the adopted code, as well as any amendments, to see if your local jurisdiction has accepted this practice. But perhaps the easiest solution is to leave well enough alone and continue using the tried-and-true step-flashing method.

Glenn Mathewson is a certified code professional and building inspector for the City of Westminster, Colo., and a frequent presenter at JLC Live.

I would encourage you to do a little homework before trying to change the decades-long practice of using step flashing with asphalt shingles.

INSTALLING CONTINUOUS FLASHING

In the roofing demonstrations I do at JLC Live, I've included continuous flashing for sidewall-to-roof intersections since 2002. But if you decide to go that route, you need to understand that water may move laterally and reach the underlayment. With that risk in mind, I recommend continuous flashing installation details designed to direct the water down slope and to resist lateral movement of water.

I start by applying a 12-inch-wide strip of self-adhering flashing tape to the roof and wall sheathing to back up the continuous flashing. If water gets under the continuous flashing, the flashing tape helps channel the water down the roof and out at the eaves. I bond 6 inches of the flashing tape to the wall and 4 inches on the roof sheathing. The remaining 2-inch portion of the roof leg doubles over and bonds to the underside of the roof underlayment. After sticking the underlayment to the tape, I tack both down with staples.

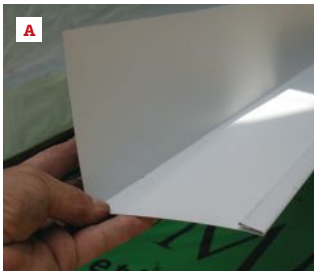
The code minimum for continuous flashing is 4 inches for both the wall and the roof legs, but I go with at least 5 inches for both to accommodate minimum off-the-roof spacing requirements for some siding. This still leaves me with more than 2 inches of flashing under the siding.

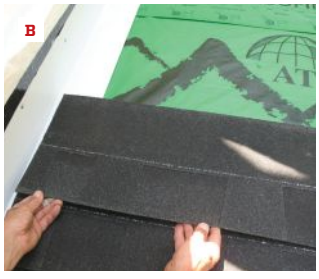
The least visible continuous flashing is installed under the shingles. While the code doesn't require a J-roll at the edge of the roof leg, as Glenn mentioned, I recommend including this easy-to-make detail when fabricating the flashing **(A)**. With the J-roll, the outer edge of the roof leg is doubled over twice to eliminate sharp edges that might cut the shingles. The J-roll helps block lateral water movement and redirects it down the slope on top of the flashing. The shingles then install on top of the flashing **(B)**. You can bed the shingles in a bead of roof cement for additional water resistance; however, doing so will make it harder to reuse the flashing with future reroofs.

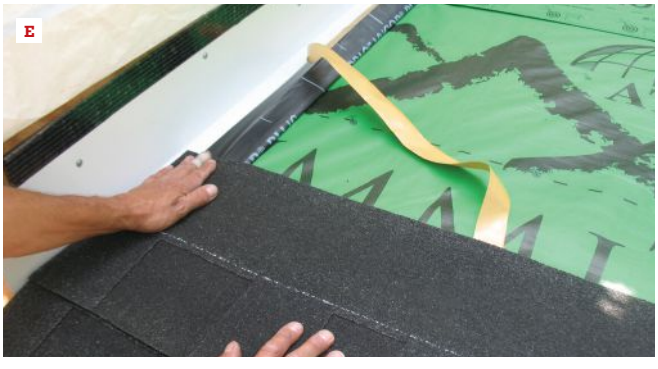
Back flashing the roof leg makes continuous flashing under the shingles even more water-resistant. I use two 4-inch strips of flashing tape. Two inches of the first strip bonds to the underside of the roof leg **(C)**. The other half of that strip bonds to the second strip **(D)**, which then folds over and bonds to the underside of the shingles to help prevent water from reaching the underlayment **(E)**.

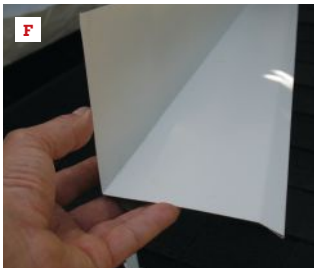
Applying continuous flashing on top of the roof shingles is another option. I recommend hemming the roof-leg edge and making a slight bend to stiffen and reinforce the edge **(F)**. The hem and the bend help the flashing resist oil-canning and lay flat on top of the shingles. Use clips to avoid fastening through the roof leg. I make the clips from scraps of flashing metal and fasten them through the shingles, spaced about 16 inches apart **(G)**. The continuous flashing sits on top of the shingles, and after fastening the vertical leg to the wall, the clips bend up and over to hold the roof leg in place **(H)**.

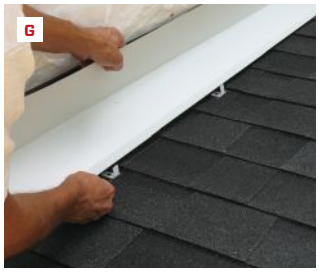
—Mike Guertin is a remodeler and custom home builder in East Greenwich, R.I., and he leads the roofing demonstrations at the JLC Live and Remodeling shows.











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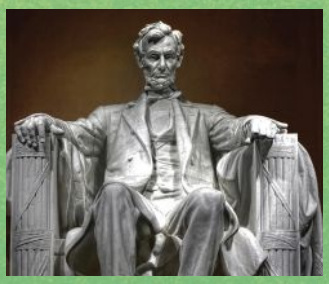

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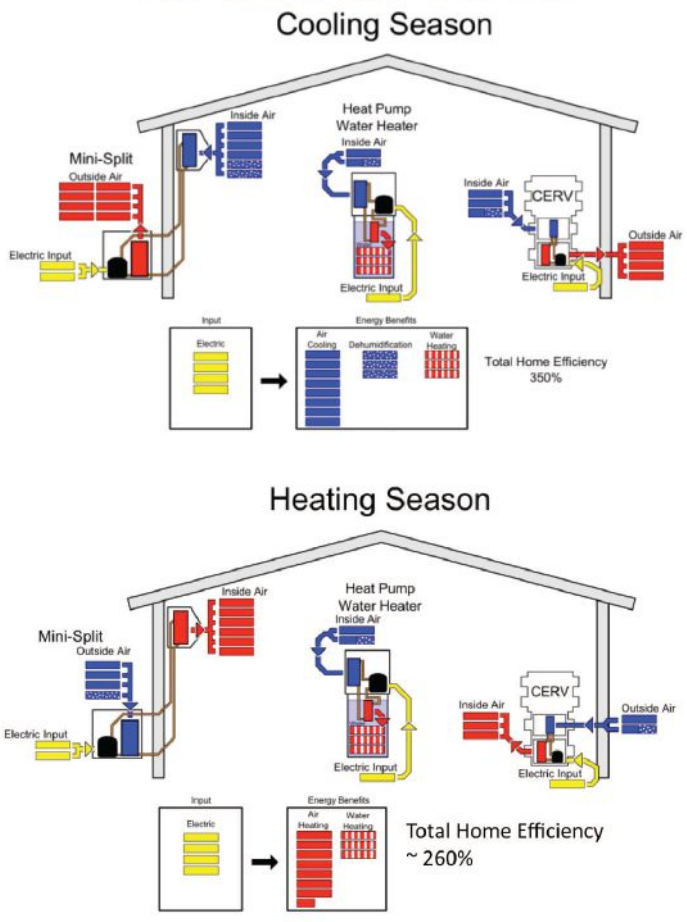
BY TED CUSHMAN

Conditioning Energy Recovery Ventilators

High-performance buildings present a special problem to HVAC designers—not because the numbers are big, but because they're small. In a superinsulated home with very low heat gain or heat loss, it can be a finicky puzzle to match the equipment to the loads. Too much capacity, and systems won't run efficiently; too little capacity, and rooms may be too hot or too cold. Too much or too little dehumidification, and rooms could be over-dry, or damp and clammy, even when the room temperature is on the money. The balancing act is trickiest in the "swing" or "shoulder" seasons of spring and fall, when calls for heating or cooling are small and intermittent, but the house still needs continual fresh air.



A three-way heat-pump tag team lets a small home squeeze more comfort from its electric supply.

Illustration: Build Equinox

Airtight and superinsulated buildings, of course, require mechanical ventilation. In warm climates, the humidity brought in by the code-required in-flows of fresh air can apply a "latent load" that challenges air conditioners—a load that looms relatively larger in the calculations for a building with superinsulated walls and roof, advanced windows, and tight air-sealing—all of which minimize heating and cooling loads associated with heat gains and losses through the building envelope.

Heat recovery ventilator (HRV) systems address the heating and cooling part of the problem by transferring heat from the outgoing airstream to the incoming one during the heating season, and doing the reverse during the cooling season. Energy recovery ventilator (ERV) systems go one better by also addressing latent loads: They transfer moisture as well as heat from one airstream to the other as needed. But both systems can accomplish only so much, because they operate passively: HRVs transfer energy from warm air to cold air, while ERVs also transfer moisture from humid air to dry air, but neither one can pump vapor or heat "uphill." An HRV's limitations are most apparent in humid climates, where incoming fresh air brings an outsize load of moisture with it; but in a humid climate, even an ERV can bring in air that's damp enough to make trouble for the air conditioning system and make the house uncomfortable for occupants. Instead of helping with the space-conditioning problem, in short, ventilation systems are often part of the problem.

Humidity control has always been an issue in hot/humid or mixed climates. *JLC* has looked at solutions to this problem in the past, focusing on variable-speed compressors and air handlers for central air conditioners (see, for example, "Air Conditioning for Humid Climates," 10/04). But those articles dealt with conventional code-compliant houses, not Passive House or net-zero homes. Conventionally-sized furnaces and air conditioners—even the ones with advanced humidity-control features—pack way too much punch for a 21st-century superinsulated home (especially a small one). The new

A Build Equinox Conditioning Energy Recovery Ventilator (CERV) is shown installed in the mechanicals room of a superinsulated 1,000-square-foot modular home in Vermont. The unit preconditions incoming air and delivers cooled or warmed fresh air to remote rooms as needed, controlling humidity and air quality as well as temperature.

generation of advanced homes needs a mechanical system with less muscle, and more brain.

ENTER THE CERV

After several years of research and development, Indiana-based Build Equinox is now manufacturing and marketing a conditioning energy recovery ventilator (CERV)—an ERV augmented with a small heat pump. The heat pump actively precools the outgoing air and prewarms the incoming air (or vice versa), before the incoming air reaches the passive heat-exchange core and after the outgoing air has already passed through the passive core.

Build Equinox systems also come with a "black box" smart control system that senses humidity, carbon dioxide (CO_2), and volatile organic compounds (VOCs) in the air, turning the system fans and heat pump on and off as needed to address the building's actual pollutant load and humidity conditions, rather than using a timer to determine the flow of ventilation air. When fresh air isn't needed, the black box responds to variations in house temperatures, operating in recirculation, or "recirc," mode to move air around and maintain an even temperature.

The value proposition? Better air quality, reduced energy consumption, improved comfort, and lower construction costs—in the cold north as well as the humid south. In humid climates, a CERV can wring most of the moisture out of the incoming air before it enters the home, delivering cool, dry air from the fresh-air registers and easing the strain on the home's air conditioner. And in a cold climate, a CERV can boost the temperature of supply air in the fresh-air ducts, allowing the ventilation system to carry some, or even all, of the heating load for rooms. With its smart controls, the CERV runs only when needed, saving energy. And although it's an active system, not a passive one, a CERV can allow designers to approach the Passive House ideal of using ventilation ductwork for space conditioning as well as fresh air—a key cost savings that could help offset the increased construction cost associated with envelope upgrades like superinsulation, meticulous air-sealing, and triple-glazed windows.

CASE STUDIES

Two cases illustrate the CERV's usefulness in meeting energy challenges: a small, affordable dwelling in the chilly Vermont climate, and a larger, custom home in warm, humid North Carolina. In each situation, the CERV helps to meet the specific needs of the climate and the design.

In Vermont, the state's energy-efficiency utility, Efficiency Vermont, has been replacing old energy-hog trailer homes with new modular units the same size and shape as the house trailers, but built with superinsulated, airtight double-stud-wall construction. Built in Wilder, Vt., by modular builder VerMod, the new units are net-zero capable, generating as much power as they consume each year with a rooftop-mounted photovoltaic solar array.

But heating and cooling the long, skinny units is a challenge. VerMod meets the need with a three-component HVAC system made up of the Build Equinox CERV, a 9,000-Btu air-source minisplit heat pump, and a heat pump water heater (HPWH).

Efficiency Vermont program manager Peter Schneider explains how it works (see illustration, page 29): "The units have a heating load of 8.4 kBtu per hour at the

Photo: Peter Schneider/Efficiency Vermont

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design temperature. We meet that heat demand with a small cold-climate ductless heat pump (a Mitsubishi FH09 or a Fujitsu 9RLS3h) and the Build Equinox CERV. The CERV can meet the heat demand down to 32°F, and below that temperature, the ductless heat pump provides the additional Btus needed to achieve the desired set point."

Schneider continues: "We meet the hot-water demand with a GE GeoSpring heat pump hot-water heater, which has a coefficient of performance (COP) of 3.1 and is quiet. The CERV and HPWH are located in a sound-dampened mechanical room, and the CERV draws air into the mechanical room from the hallway at about 30 cubic feet per minute (CFM) to mix the air for the HPWH."

Most of the dwelling's cooling demand can be met with the CERV's cooling capacity, in combination with the HPWH, says Schneider. "The CERV captures the cool, dehumidified exhaust air from the HPWH, combines that with its own cooling and dehumidification capacity, and delivers that air to all the living spaces via the ventilation air," he explains. Only during extended bouts of hot, humid weather is the ductless minisplit called on to help with cooling.

The CERV also manages indoor air quality in the small dwellings, "continually evaluating the indoor air quality with CO2 and VOC sensors in the return airstream," says Schneider. "The occupant sets the desired ppm for the air quality (we recommend 1,000 ppm) and the CERV recirculates the air unless the ppm is exceeded, and then it brings in outside air. The CERV exhausts air from the kitchen and bathrooms and supplies air to the living areas and bedrooms."

So far, the Vermont program has set more than 20 net-zero dwellings in the field, and the builder, VerMod, is producing another unit every month. Efficiency Vermont has instruments in place to monitor air quality and energy consumption in all the houses, and on average, the units are living up to their zero-energy billing, Schneider says. The design is also working comfort-wise. "I know of energy-efficient houses where there are 5-degree or 10-degree temperature differences between rooms," says Vermod executive Chet Pasho. "In our houses, the temperature in the bedroom stays within a degree or two of the temperature in the living room, where the minisplit is located."

A close-up of the remote-control display for the Build Equinox shows readouts for temperature, humidity, carbon dioxide, and volatile organic compounds.

While a CERV can offset space-conditioning demand in a low-load home, Build Equinox isn't pushing the system as a space-conditioning solution. The primary focus is air quality. Build Equinox president Ben Newell says the smart controls—in particular, the sensing instruments that detect excessive CO2 and VOCs—are a key advantage. The two types of sensor are independently valuable, he says: Excessive CO2 can affect comfort and is an indicator of occupancy, but the VOC sensor has its own purpose. Build Equinox offers an optional module that reports on air quality over the Internet. "In a few of the homes," says Newell, "the VOC sensor has detected gas leaks that needed to be fixed. And in one of the VerMod homes, all the furnishings are supposed to be low-VOC finishes, but one of the countertops was mixed up in delivery from a supplier. We were seeing higher VOCs, and that's how they found out that they had the wrong countertop."

North Carolina CERV. Humidity is not a pollutant, exactly. But in the hot and humid South, it can certainly be an air-quality problem. That's the reason Kevin Murphy, a Passive House builder in Chapel Hill, N.C., turned to the Build Equinox CERV. "I used conventional ERVs in my first couple of houses," Murphy says. "And the one complaint I got from my clients—particularly in the first year when all that water was drying out from the slab, the lumber, drywall mud, and so forth—was that they were uncomfortable in the house. So I was excited when the CERV became available." Murphy got his first CERV in time to install it in a home that had been designed for a conventional ERV.

Murphy builds custom homes on big lots, and he can orient his houses to optimize seasonal solar exposure. With triple-glazed windows and careful siting, he says, "heating the homes is not a problem"—solar gain takes care of it. "Cooling the homes is more the problem," he says. "And conventional ERVs are great, but you're pumping humidity into the house in summer. They're not capable of dehumidifying." By capturing and eliminating outdoor moisture before it comes into the house, the CERV keeps the indoors dry. And like the Vermont modulars, Murphy's newer homes follow the strategy of cooling a central area with a small minisplit and using the CERV to draw stale air from central rooms, the kitchen, and the baths and supply conditioned air to bedrooms. "I'm a fan," says Murphy. "I've only installed one, but I have three more on order. I'm pretty much including it as a standard feature now."

Ted Cushman is a senior editor at JLC.

Photo: Ted Cushman

BRICK VENEER

Brick Veneer That Works
Strategies for avoiding failure

BY HARRISON MCCAMPBELL

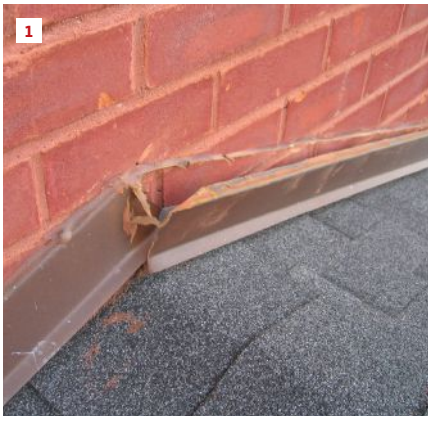
As a forensic architect, I see a lot of building failures due to poorly installed brick veneer. While brick is an extremely durable and water-tolerant cladding material, it cannot overcome poor workmanship and poor detailing. It certainly is not water*proof*, and care must be taken to protect the structure behind the veneer. Unfortunately, I don't see this care on the projects I visit. (Of course, I wouldn't be on a project if something wasn't wrong.) Again and again I see the same mistakes made, many of which lead to very expensive callbacks.

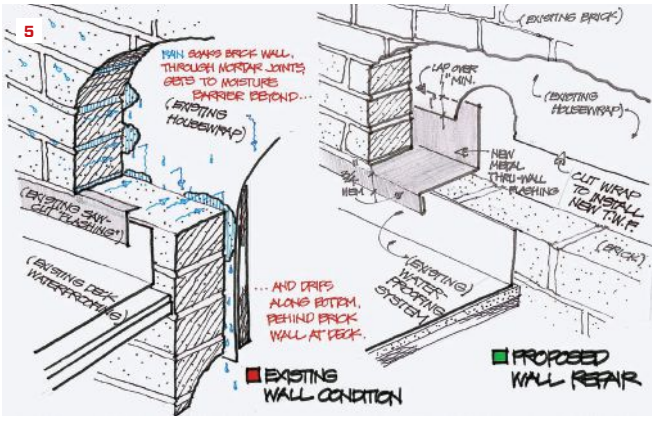
In this article, I'll share what I've learned in my forensic work, beginning with some of what doesn't work. Seeing the results of doing things the wrong way helps to explain why the details I advocate as best practice are worth doing in the first place, even if they seem a bit excessive at first.

Photos: Harrison McCampbell

HOW BRICK VENEER CAN FAIL

Rarely does the brick installation itself fail. Laying up a flat wall with straight, even courses and raking the mortar joints is often done well. The challenge is making sure that the brick is supported properly, that it's securely tied to the structural wall, and that the proper moisture-control measures have been taken to ensure that moisture won't affect the wood framing behind the brick veneer.





Modern brick fired at high temperatures can be fairly water-resistant. Older bricks are typically more porous and will absorb a surprising amount of water. But regardless of the type of brick, water will find its way through the cladding.

For starters, there are all the common leak spots, such as roof and wall penetrations and (of course) windows. In addition, mortar joints in a brick wall tend to leak. Mixing mortar introduces tiny air bubbles. Once troweled on, the water in the mix evaporates, leaving even more holes, as well as lots of hairline cracks between the mortar and the brick. Wind-driven rain will soak the wall, and as the moisture moves from wet to dry and warmer to cooler, the back of the brick will eventually get wet—you can count on it.

THROUGH-WALL FLASHING FAILURES

On a surprising number of the brick projects I am called in to investigate, the failure stems from a lack of proper through-wall flashings.

A classic example of a detail that often fails is counterflashing installed where a sloped shingle roof abuts a brick wall **(1)**. The metal is usually 4 or 5 inches high and follows the slope of the roof. The flashing shown here has simply been let into a saw kerf in the brick and held in place with caulk or the occasional nail wedged between the metal and the brick. Inevitably, the flashing falls out of the wall, and then it offers no help whatsoever.

Similar meager attempts were made to flash a chimney **(2)**, a headwall **(3)**, and a gable-end parapet wall **(4)**. All used saw-cut flashings that provided little protection from water flowing down the roof and zero protection from rain soaking the wall above the flashing.

Any water that gets behind the brick will be headed right down into the framing and the interior finishes, as I've illustrated above for one wall repair **(5)**. A proper through-wall flashing (shown as the "proposed wall repair") must run from under the weather-resistive barrier on the structural wall and extend all the way through the brick to the exterior; anything short of meeting the front face of the brick is much less effective at getting the water out.

WEEP HOLES

Through-wall flashing works in concert with weep holes to gather the water that leaks past the brick face and give it a path

to drain safely away. According to the Brick Industry Association (BIA), weep holes should be placed every 24 inches on-center (or every 16 inches when cotton rope is used as a wick).

I would rather see a wall with good through-wall flashing and too few or even no weep holes than a wall with weep holes and no or poorly installed through-wall flashings. Even if there are no weep holes, when there is a proper through-wall flashing that terminates on the face of the wall, the collected water will eventually evaporate or escape through the tiny cracks in the mortar before it can damage the framing. But without through-wall flashing, weep holes won't do much of anything.

STEPPED PAN FLASHING

Admittedly, installing through-wall flashing correctly, particularly on a sloped roof-to-wall intersection, involves a detailed process and requires close coordination between the roofer and the mason. As painstaking as this can be, it's the only way to prevent water from seeping into the living space below.

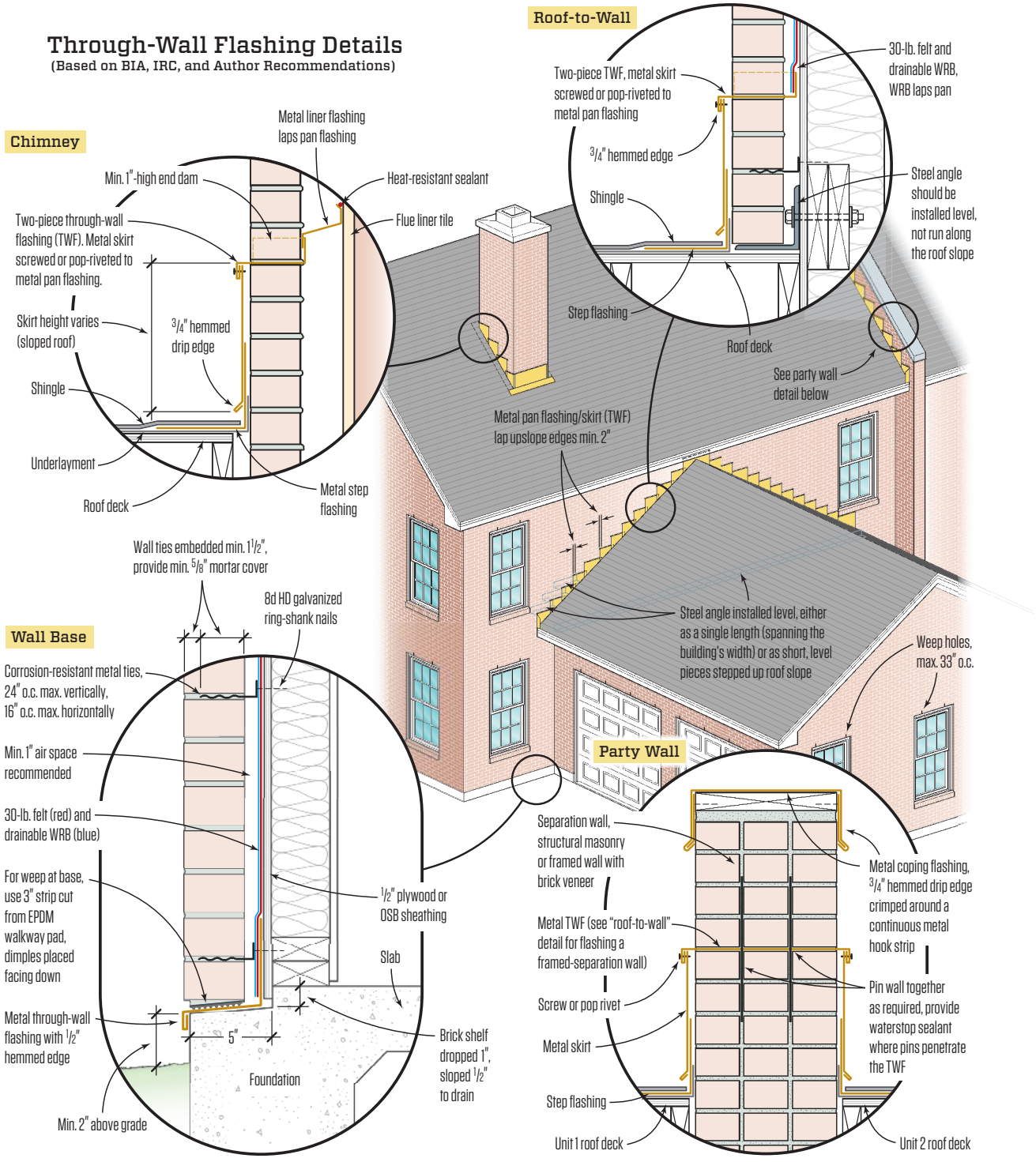
Stepped pans. Executing a true through-wall counterflashing along the rake of a sloped roof requires installing a series of stepped pans. On the job shown above, the masons began by building up the brick in stair-step fashion **(6)**. The rise and run of these stair steps will vary with the pitch of the roof, but each step will be the same because the slope stays the same and the brick coursing is the same.

Next, the masons laid in copper pans **(7)**. A key feature of these pans is the soldered end-dams that direct water onto the front edge of the pan **(8)**. This edge laps over the front of the brick about ½ inch, providing a lip to which the counterflashing will be attached.

On this particular job, we had been called in because of the severe cracking of the brick across the entire gable-end wall **(9)**. All of the unpainted brick shown was removed. We discovered that only three brick ties had been installed high up on the wall near the gable vent. There were no brick ties whatsoever across the entire area below it. It was lucky that this wall had not come down entirely.

When we replaced the brick, we included the stepped pan flashings where the sloped roof joined the gable-end wall (at left behind the railing in photo 9 above; the railing was removed for the demolition phase).

When everything had been cleaned up from laying the new brick, copper skirts were slid up under the front edge of each pan and pop-riveted or screwed in place **(10)**. These copper skirts


Through-Wall Flashing Details
(Based on BIA, IRC, and Author Recommendations)
Chimney
Metal liner flashing laps pan flashing
Min. 1"-high end dam
Heat-resistant sealant
Flue liner tile
Two-piece through-wall flashing (TWF). Metal skirt screwed or pop-riveted to metal pan flashing.
Skirt height varies (sloped roof)
3/4" hemmed drip edge
Shingle
Underlayment
Roof deck
Metal step flashing
Roof-to-Wall
Two-piece TWF, metal skirt screwed or pop-riveted to metal pan flashing
30-lb. felt and drainable WRB, WRB laps pan
3/4" hemmed edge
Shingle
Steel angle should be installed level, not run along the roof slope
Step flashing
Roof deck
See party wall detail below
Metal pan flashing/skirt (TWF) lap upslope edges min. 2"
Steel angle installed level, either as a single length (spanning the building's width) or as short, level pieces stepped up roof slope
Weep holes, max. 33" o.c.
Wall Base
Wall ties embedded min. 1 1/2", provide min. 5/8" mortar cover
8d HD galvanized ring-shank nails
Corrosion-resistant metal ties, 24" o.c. max. vertically, 16" o.c. max. horizontally
Min. 1" air space recommended
30-lb. felt (red) and drainable WRB (blue)
For weep at base, use 3" strip cut from EPDM walkway pad, dimples placed facing down
1/2" plywood or OSB sheathing
Slab
Metal through-wall flashing with 1/2" hemmed edge
5"
Brick shelf dropped 1", sloped 1/2" to drain
Foundation
Min. 2" above grade
Party Wall
Separation wall, structural masonry or framed wall with brick veneer
Metal coping flashing, 3/4" hemmed drip edge crimped around a continuous metal hook strip
Metal TWF (see "roof-to-wall" detail for flashing a framed-separation wall)
Pin wall together as required, provide waterstop sealant where pins penetrate the TWF
Screw or pop rivet
Metal skirt
Step flashing
Unit 1 roof deck
Unit 2 roof deck

serve as a counterflashing to the stepped L-flashings that the roofers wove in with the new roof shingles.

TWO-LAYER WRB

While the lack of brick ties caused the initial failure on the gable end, when we took the brick down, we discovered a number of other flaws. The most glaring was a combination of excessive mortar squeeze-out on the back surface of the brick, along with a very cheap and poorly installed weather-resistive barrier.

A single layer of housewrap provides almost no barrier to water when mortar comes in direct contact with it. Water that leaks behind the brick wicks along the excess mortar to the face of the WRB and then seeps right through, wetting the wood sheathing.

Cavity or not. Currently, building codes require a minimum 1-inch air space between the brick and the structural wall. (This requirement could be challenged when you're using some of the newer self-adhesive or liquid-applied WRBs in tandem with a drainable insulation, such as mineral wool. See "Challenging Tradition," pages 41 and 42.)

In theory, this space provides a drainage path and enough space to keep mortar, and any water it holds, safely away from the WRB that guards the wall sheathing.

In practice, however, that gap is not enough to always keep mortar at bay. On a recent job, one mason proved this point **(11)**. Right around the corner on the same building, a different mason did a much better job of keeping the cavity clear **(12)**. This variation in workmanship is inevitable and is why I insist on a double-layer WRB.

Asphalt felt plus a drainable wrap. In my opinion, brick—like stucco—should be installed over two moisture barriers, as shown in the detail illustrations on the facing page. I like to see a layer of #30 asphalt-impregnated organic felt covered with a "drainable" housewrap, such as Tyvek StuccoWrap or CommercialWrap D. Both of these wraps are "crinkled" to create a textured surface, which forms channels that help drain water down the face of the WRB.

There are several other textured building wraps on the market. Steer clear of woven building wraps. These abrade easily and the holes between the woven filaments don't do much to keep water out. I recommend choosing a commercial-grade WRB, which will be a little more resistant to abrasion and UV exposure. Durability

is key in any working environment where masonry is being used.

The more durable building wrap will protect the asphalt felt from the sun during construction. It acts as a first line of defense against any moisture that leaks past the brick. The felt is there as protection against any moisture that seeps through the building wrap, as it will at every transfer point where mortar slops against the WRB.

WINDOW AND DOOR FLASHING

Ideally, window and door head flashing would be fabricated out of metal and formed with end dams, similar to the stepped pans for roof-to-wall intersections. Membrane flashings that extend to the exterior will eventually weather and deteriorate. But even if a membrane flashing is used and it extends well past the side of the window, it can work.

In the example shown on page 39 **(13)**, you can see the rusted angle going across the top of the window. The membrane over it extends beyond the sides of the rough opening and comes out the exterior face of the brick. Provided the membrane laps under the WRB, this is a serviceable attempt to keep water off the head of the window. The problem, of course, is that it looks bad.

A good alternative to membrane flashing is a thin copper sheet laminated to waterproof Kraft paper. Two sources are York Manufacturing (yorkmfg.com) and MasterCraft Metals (mastercraftmetals.net). Because the copper is thin, it's not too noticeable on the face of the brick. It doesn't shrink, and it withstands the compression of the masonry and resists the acids and alkalis in mortar. This material can be turned up to make little pigs' ears at the corners to form end dams, and the Kraft paper will protect the copper from galvanic reaction with the lintel. If you're using a bare-copper pan flashing at the head, you will need to apply a strip of peel-and-stick over the steel before setting the copper pan.

The steel angle is for structural support only; it should not be used for flashing. Some contractors will lap the WRB over the top leg and rely on the angle alone to divert water to the exterior. More often, though, the steel is installed on top of the housewrap **(14)**. (Note the brick ties, as well, in this photo. They were affixed to the sheathing but were never bent over and embedded into the mortar.)

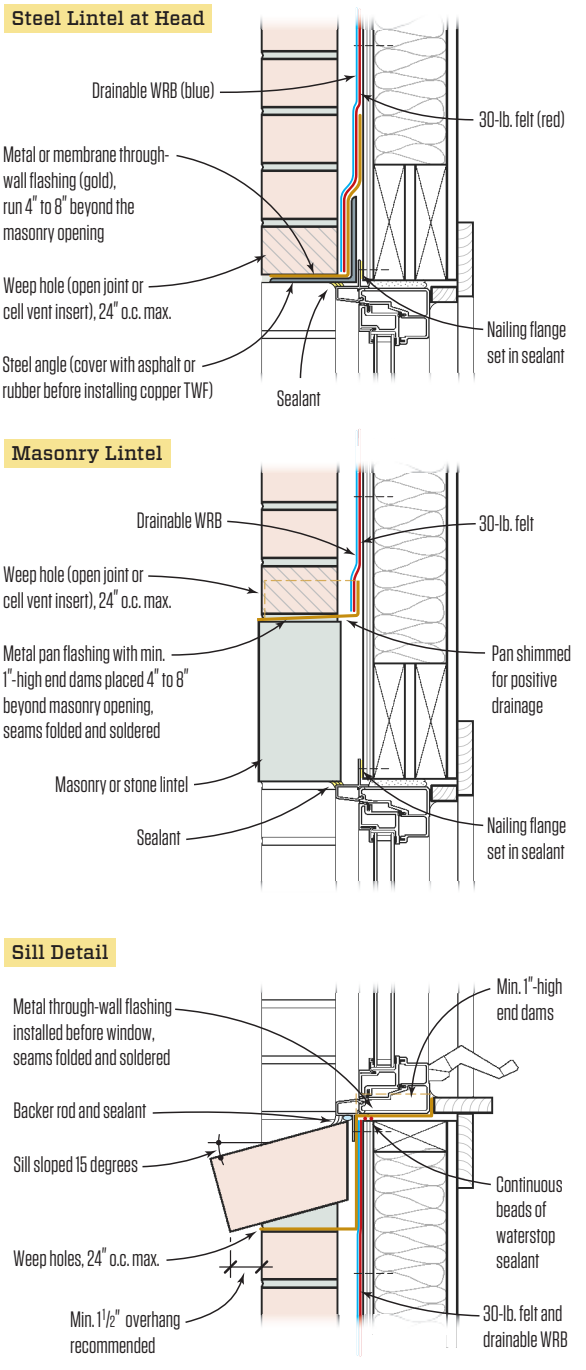
Window sills should always be sloped at least 15 degrees, per BIA standards, and should overhang the face brick by at least 1½ inches. Too often, I see flat brick sills that barely poke past the facade, providing very little positive drainage of all the water that sheets off the face of a window.

Through-wall flashing should also be placed under the sloped course of brick immediately below the window. This is meant to catch any water that makes its way into the wall cavity through or around the window.

Harrison McCampbell is a consulting forensic architect in Brentwood, Tenn., specializing in moisture-related construction defects. You can find him online at MCA4N6.com.

Window Flashing Details

(Based on BIA, IRC, and Author Recommendations)



CHALLENGING TRADITION: NEW MATERIALS MAY LEAD TO A CODE CHANGE

Bulk water management is one of the main functions of a wall assembly. When rain hits the side of a building, the wall needs to direct the water down and out, away from the structure. The wall also needs to be able to dry if it does get wet.

That's all very simple in theory, but it can get complicated in practice—especially with brick walls. Brick is porous and holds water. Some of the water that hits a brick wall soaks in, and in the case of a single-wythe brick veneer, some of it even soaks through to the back of the brick. Water doesn't hurt brick, but it could damage whatever lies behind the brick.

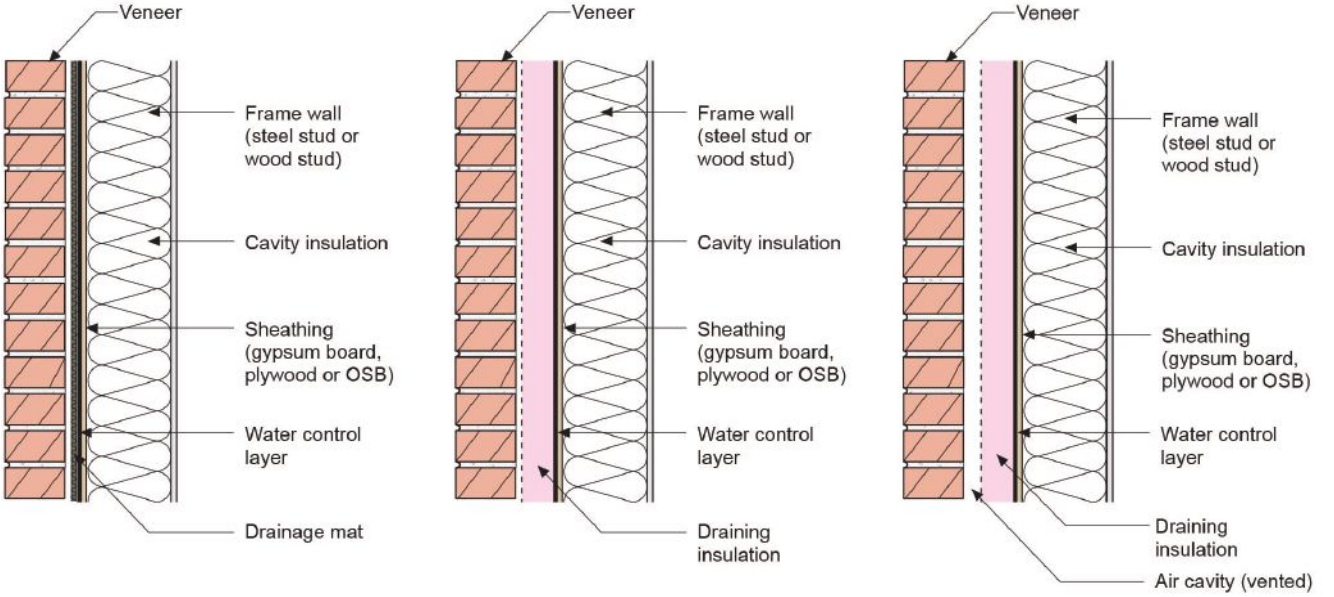
The masonry trade has traditionally detailed brick to handle soaking rains with a generous air space behind the brick and flashing. The air space not only allows water to flow down the back face of the brick, but—provided it has air inlets top and bottom—also allows air to flow in and help dry the brick. The flashings collect any water that leaks behind the brick and direct it out weep holes and onto the face of the wall.

Some building scientists, however, are increasingly taking another approach. Instead of focusing on the masonry, they focus on waterproofing the structural wall that sits behind the brick. If you create an effective water-control layer on the structural wall—which is possible with today's self-adhesive and liquid-applied WRBs—you may not need through-wall flashing. And if you use a drainable filter fabric or drainable insulation material—materials that will allow the wall system to drain, even if some mortar falls down behind the brick—on the face of the backing wall, you may not need the air space either.

Building-science expert Joe Lstiburek lays out the justification for this view in a recent paper titled "Vitruvius Does Veneers." Lstiburek points to the "Ten Books of Architecture," written in about the year 15 A.D. by Roman architect Marcus Vitruvius Pollio: "... if a wall is in a state of dampness all over, construct a second thin wall a little way from it on the inside, at a distance suited to circumstances, and in the space between these two walls run a channel ... with vents to the open air. ... when the wall is brought up to the top, leave air holes there. For if the moisture has no means of getting out by vents at the bottom and at the top, it will not fail to spread all over the new wall."

Vitruvius went on to specify brick ties: "In the course of time, the mortar has lost its strength ... and so the monuments are tumbling down and going to pieces ... He who wishes to avoid such a disaster should leave a cavity behind the facings, and on the inside build walls two feet thick, made of red dimension stone or burnt brick or lava in courses, and then bind them to the fronts by means of iron clamps and lead."

There you have it: 2,000-year-old instructions for ventilated cavity walls with a structural backing wall, brick veneer, and masonry wall ties. As for the air space between the walls, Lstiburek observes, Vitruvius left wiggle room with his phrase "a distance suited to circumstances." According to Lstiburek, the strict 1-inch air-gap requirement in today's building code doesn't always suit today's circumstances. On the contrary, he argues, a practical approach is to modify the air gap depending on the main wall



When using an advanced water-control layer, such as a self-adhesive or liquid-applied membrane, and a drainage mat or a draining insulation, such as mineral wool, no air cavity is needed. However, in IECC Climate Zone 5 and higher, and in areas with annual rainfall over 20 inches, a minimum 3⁄8-inch air cavity with vent openings top and bottom (far right) should be maintained.

Building Science Corporation

characteristics and the climate.

Lstiburek also takes issue with the traditional practice of through-wall flashing at window heads and windowsills. If a flanged window taped to housewrap is sufficient for wood or vinyl siding, he argues, there's no reason it can't work as well behind brick veneer.

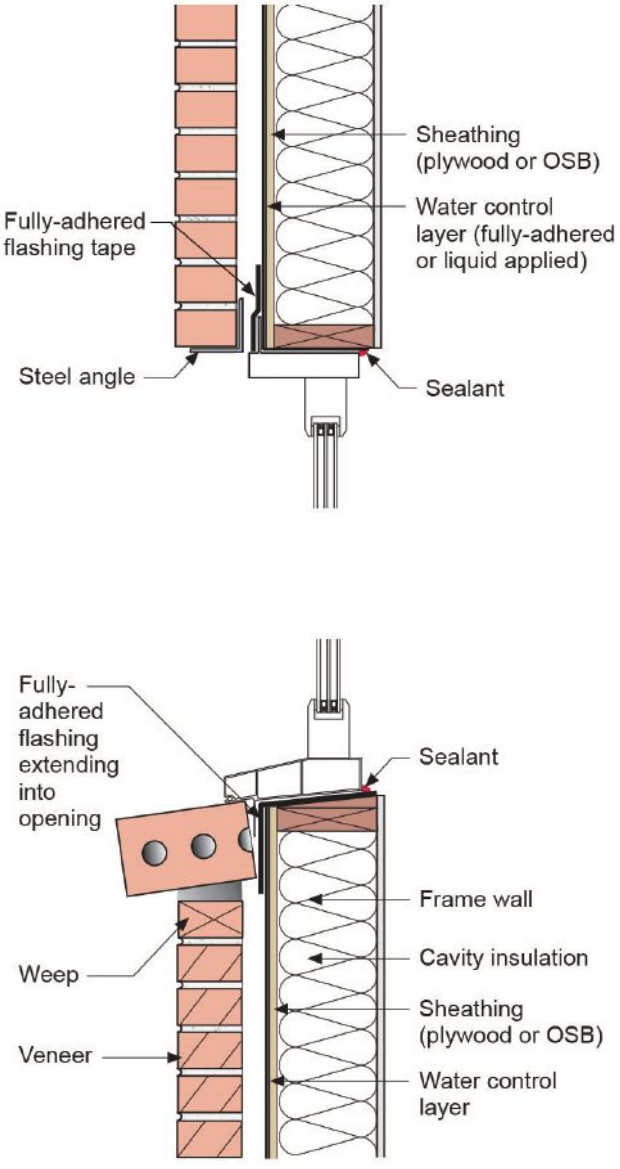
Masonry wall systems have evolved rapidly since the middle of the last century. Early on, Lstiburek observes, designers embraced a two-layer concept: pairs of single-wythe brick walls tied with 2-inch to 3-inch ties (based on the strength limits of the ties). Next, designers beefed up the inner masonry walls, evolving the classic concrete block masonry wall with brick cladding—again, with an air space of 2 to 3 inches.

Those traditional walls had no waterproofing over the masonry backing wall, notes Lstiburek. They needed a hefty air space so that masons could keep the gap free of mortar droppings—otherwise, mortar would keep the space from draining, and water trapped inside the wall could pool against the masonry, creating hydrostatic pressure that led to trouble.

But these days, Lstiburek says, masonry backing walls are routinely waterproofed, as are light-gauge steel or wood-framed walls behind brick veneer. Builders now also use drainage mats, too, which drain walls, relieve hydrostatic pressure, and create a capillary break, despite any mortar droppings. Even better, Lstiburek notes, we now have materials such as mineral wool that can insulate between the brick and the house wall while still allowing drainage. If you're building a system with a waterproofed main wall and a drainage mat or drainable insulation layer, argues Lstiburek, you don't need any additional air gap at all—at least not for drainage or drying.

Code challenge. In an email, Lstiburek told *JLC*, "A code change proposal is coming." Lstiburek and his organization, Building Science Corporation, have been successful at spurring code revisions in the past—most notably in the case of interior-wall vapor barriers, where Lstiburek was instrumental in the effort to repeal requirements for poly under drywall in most climates. Lstiburek said his suggestion to omit the air space behind the brick—provided the wall has waterproofing and a drainage mat or drainable insulation, and the plans have been stamped by an architect or engineer—has been accepted many times on a case-by-case basis by code authorities.

But Lstiburek offers a couple of cautions. In climates with freeze/thaw conditions, he says, the air space helps dry the back of the brick veneer. This space should be kept as protection against frost damage. Lstiburek says experience teaches that a gap of ⅜ inch should be plenty for those purposes. Lstiburek also notes that the gap allows masons to meet visual construction tolerances. If the backing wall isn't perfectly regular and flat, the gap allows masons to maintain a flat face on the side people can see. The larger the building and the masonry wall area, the more room masons are likely to need. So even if building science doesn't justify requiring the gap, the gap will remain an option that many builders will continue to choose for practical reasons. —*Ted Cushman*



Self-adhesive and liquid-applied water-control membranes will reportedly protect the structural wall well enough that head and sill flashings can drain into the cavity instead of coming through the brick to the exterior face.

Building Science Corporation

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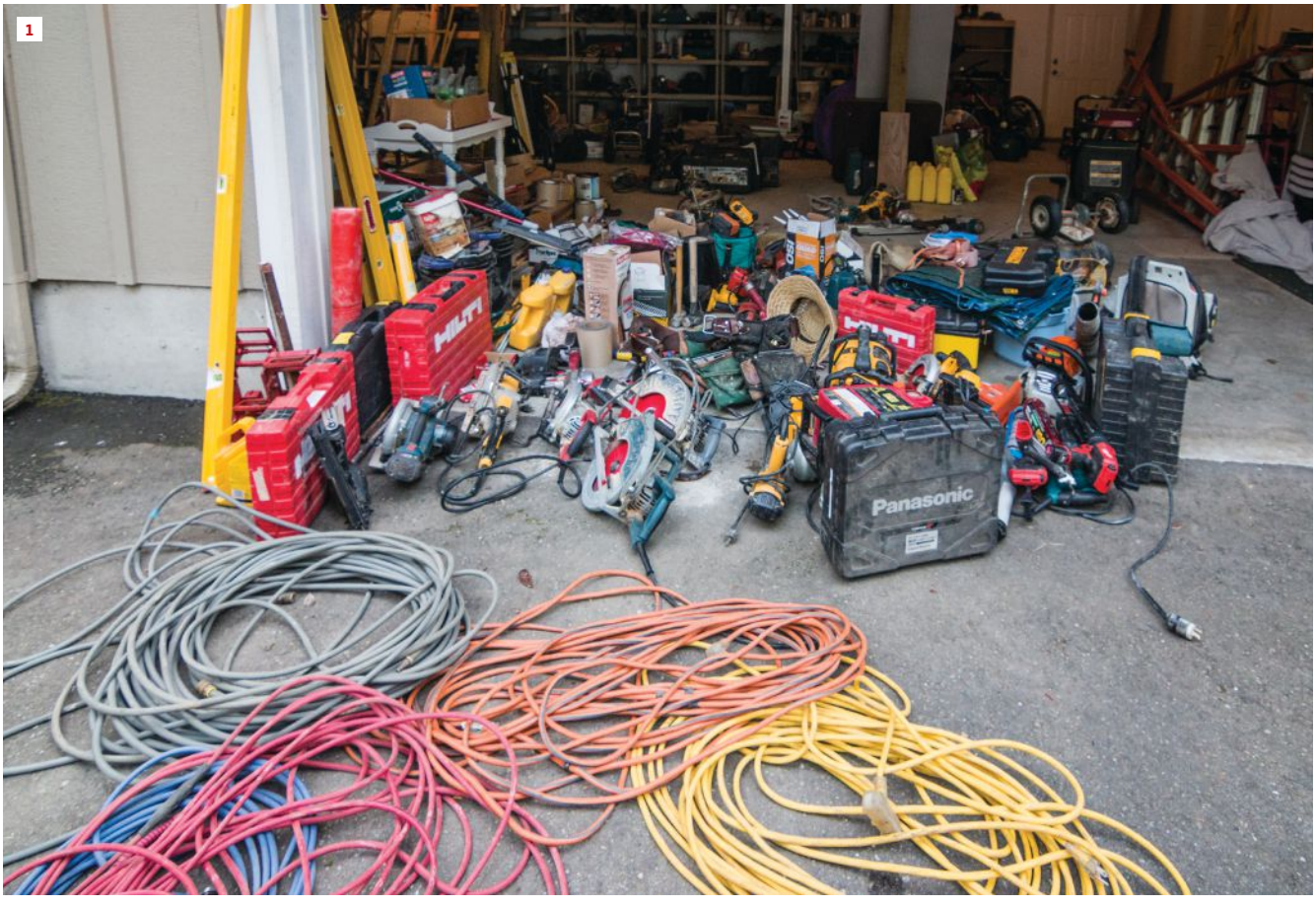


A Framer's Tool Kit

Choosing the tools we wouldn't want to be without

BY TIM UHLER

During a recent lull between projects, we decided to clean out the box van we take to the jobsite, and do a little reorganizing. When everything was spread out on the ground, we couldn't believe how much stuff we had packed inside. Some of the tools didn't get a lot of use and were just taking up space and making it harder to find tools we wanted to use. When it was time to reload, we wanted to be careful about what went back in the van, so we compiled a must-have list of tools for framing and exterior finish work. Other than what we carry in our tool bags, those are among the most essential tools in our arsenal. Here's a look at some of what we decided to keep.

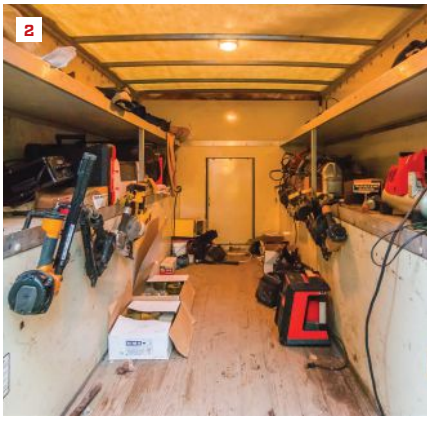
Photos: Tim Uhler

1. WHAT CAME OUT

We had accumulated a small mountain of tools over the years as tools went into the van without anything coming out. It was clearly time to weed them out.

2. A CLEAN SLATE

Once the van was emptied of tools, we reorganized. The van has exterior utility boxes on both sides, and shelves plus a 12-by-4-foot open area on the inside. After we restocked it, there was plenty of room. The spring cleaning paid off: It was easier to find the tools we needed, and we weren't lugging around extra weight for nothing.



3. CIRCULAR SAWS

We have a bunch of 7 ¼-inch wormdrive saws. Of these, the Skil Mag 77LT is our current favorite because it's very light. But for deeper cuts, we have a 10 ¼-inch Big Foot head mounted on a Bosch body. And although we rarely use it, we also have an even larger, 14-inch Big Foot. When these bigger saws are used, one trick is to spray a friction-reducing dry coating on the blade; we use Dri-Cote. A 10 ¼-inch Big Foot conversion kit, which doesn't include the saw, runs about $310. bigfootsaws.com

4. SAW BLADES

We have been using Diablo circular saw blades since 2004 and buy them in packs of 10. Prior to that, we used Marathon and Matsushita blades. We've tried other blades as they come out but always go back to Diablo. Its blades last, and the red coating does seem to make them cut more smoothly. We use a 10 ¼-inch blade on our larger saw. diablotools.com

5. COMPRESSOR

We bought into the Max high-pressure system in 2008, and we've never looked back. The AKHL 1230E compressor (since superseded by the AKHL 1250E) has regulators and outlets for both high-pressure (500 psi) and standard-pressure (100 psi) tools, so it will power every nailer we have in the truck. Its 2-hp motor runs on 110-volt current. It costs $1,350. maxusacorp.com

6. CONNECTOR NAILERS

It's just not practical to install by hand all the hardware that's required these days, so we carry two metal-connector nailers. We've used many brands, but the Senco Joist Pro 150XP and Joist Pro 250XP are our favorites. These guns save us a lot of time. Both have performed well, and we appreciate the large swivel belt hooks that are standard. Of the two, I like the JoistPro 250 best because it holds the 2 ½-inch nails we typically use. But I wouldn't hesitate to buy either one. The JoistPro 150 is $220; the JoistPro 250 is $300. senco.com

7. STICK NAILER

There are times when a stick nailer is really helpful. We keep a Bostitch LPF21PL on the truck for shooting galvanized framing

nails. Hot-dipped galvanized stick nails are cheaper and easier to find than galvanized coil nails. This Bostitch uses regular air pressure and costs $220 online. bostitch.com

8. COIL FRAMERS

Coil framing nailers hold more nails than stick framers, so we spend less time reloading—that's why we like them. We have two Max HN90 high-pressure guns, which have been reliable. They're light and powerful and never break down. Our only maintenance has been to replace one seal on one of the guns. Despite the wear on the outside, the tool was extremely clean on the inside when we opened it up, a sign the internal filter is doing its job. The nailer retails for about $600. maxusacorp.com

9. PLUNGE ROUTER

Sheathing walls doesn't take long, but cutting out window and door openings can be slow. That's why we keep a plunge router on hand. Nothing else comes close to its efficiency. Circular saws require too much layout, recip saws are slow and make rough cuts, and chain saws are not only loud and dangerous but also make a terrible mess. For the last 10 years, we've carried a plunge router with a flush-cut bit. It's fast, requires no layout, and leaves a smooth, flush edge at the opening. We use a Bosch 1619EVS, a 3¼-horsepower model that retails for about $320. boschtools.com

10. DEEP SOCKET

To avoid carrying bolts in a variety of lengths, we often fasten beam hardware with threaded rod instead. We tighten the nuts with an impact wrench and a Dude Buster deep socket. Its 7-inch depth lets us tighten the nut without cutting off excess rod. Dude Busters come in seven sizes, from ½ inch to 1¼ inches, and are made in the U.S. They sell for about $100 at Amazon. dudetools.com

11. RECIP SAW

Our corded recip saw (we have been using the same Makita JR3050T since 2005) has long been our go-to tool for cutting through wood, wood with nails, and even threaded rod. But since we bought a cordless Milwaukee M18 Fuel recip saw (2720-22), we've used that most of the time. It's more than powerful enough

for most of our needs, and working without a cord is so convenient. It costs about $400 online. milwaukeetools.com

12. DRILLS

To bore holes for J-bolts and through-bolts on some hangers and for large hole saws, we have retired our ½-inch corded drill and now rely on the Makita XPH07T cordless hammer drill (see review on page 68). It has enough power to bore ¾-inch holes through a glulam, for example, or to handle a 3-inch hole saw. makita.com

For smaller drilling needs (⅝ inch or less) and for hanging doors, we use a compact DeWalt 20V brushless drill/driver (shown above). We power it with either full-size or compact battery packs, but we especially like the lighter weight of the smaller packs. We have gathered an eclectic collection of cordless tools and if we had to start over, we would probably stick with tools from just one of our favorite brands. Having tools that all use the same batteries would make things somewhat easier. dewalt.com

13. IMPACT DRIVER

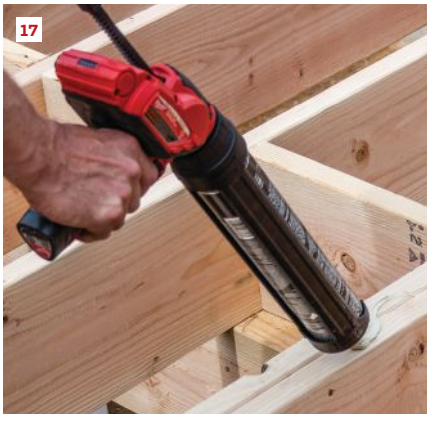
It's not unusual to get a nut started only to have it hang up on damaged threads. Our 10-year-old DeWalt electric impact driver, now the model DW292, powers the nut right on. It's so powerful, we must be careful not to over-torque the nut, and we typically finish tightening by hand. The DW292 has a ½-inch drive and delivers 345 foot-pounds of torque. It's available for $140 online. dewalt.com

14. ROTARY HAMMERS

We seem to end up drilling into concrete on every house we frame, so we keep a couple of Hilti rotary hammers on hand. The smaller TE2 gets the most use. It's capable of boring ⅝- or ¾-inch-diameter holes for anchors and threaded rod in the relatively green concrete we usually encounter. We keep the larger TE76 (now the TE70) for making holes larger than 1 inch, such as the 3-inch holes we drill from time to time through a concrete patio or stem wall to connect a downspout. The TE2 starts at $230; the TE70 retails for $1,700. us.hilti.com

15. WALL PULLER

We use wall pullers to straighten bowed bottom plates before nailing them down. Drive one tip into the plate and the other into the



subfloor, then push or pull on the handle to align the plate with the layout line. A number of companies make them; this one is from Qualcraft Industries and is called the Pee Vee. It comes in two sizes, both of which are helpful. The larger of the two sells for about $25, the smaller for $20. qualcraft.com

16. LEVELS

We have an assortment of Stabila levels, but the 72-inch and 24-inch R Beam levels are the ones we use most often. I use the 72-inch model both as a level and for marking sheet goods. It's stiff enough that it won't deform when pressed against a bowed piece of plywood. The "R" profile provides three sharp edges that can be used for drawing or scribing straight lines, and the curved edge makes a comfortable grip. The levels come in several lengths, and the vials are guaranteed to be accurate for life. These levels do not need to be babied. Prices vary by length; the 6-foot model is about $210. stabila.com

17. SUBFLOOR GLUE GUN

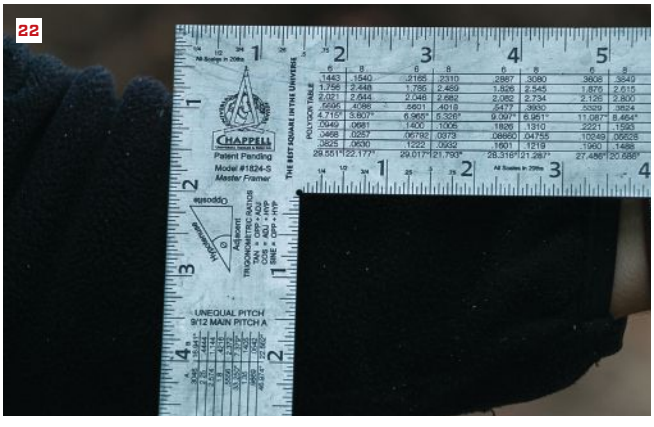
We switched from a pneumatic caulking gun to an M12 battery-powered model from Milwaukee. The pneumatic worked just fine, but it's more convenient not to be tethered to a hose when we're walking joists. The same gun can accommodate all size tubes—10-ounce, quart-size, and (with the aluminum tube included) sausage rolls. milwaukeetool.com

18. IMPACT WRENCH

Our Panasonic cordless impact wrench (EY7551) can be converted from a ½-inch socket drive to a standard ¼-inch-bit impact drive with a bit holder. It's versatile enough to drive large anchor nuts as well as the 3 ⅝-inch LedgerLok and 6-inch and 8-inch TimberLok screws we use. It's about $390 online. shop.panasonic.com

19. LAYOUT STICK

Big Foot's layout stick saves us a ton of time on wall layouts. About as fast as I can walk along the wall, I can mark stud layouts, 4 feet at a time. Leapfrogging the layout stick accumulates a slight error, equal to the thickness of the pencil lead every 4 feet, so we're automatically leaving a gap for our wall sheathing. The older, welded model I prefer is no longer available from Big Foot (it is



still sold by McDonald Manufacturing and Best Construction Tools); newer Big Foot models have plastic fold-out arms and sell for $25. bigfootsaws.com

20. LASER PLUMB BOB

A laser plumb bob is a must-have tool for us. We frame a lot of tall walls and rakes and routinely need to plumb 20-foot-high walls. It's also great for transferring a layout from floor to ceiling. The level line it projects is handy for hanging a series of windows or shooting level for porch columns. The DeWalt DW0822 is as good as any we've used, and it's reasonably priced. It's a combination laser, meaning it is both a line laser and a dot laser. It has several good features, like magnets in the base so the tool can be attached to a metal surface, and a pendulum lock that protects the internal mechanism from damage in the event the laser is dropped. They're about $240 online. dewalt.com

21. SELF-LEVELING LASER

The Pacific Laser Systems PLS90E is another real time-saver. It shoots lines 90 degrees from each other to project on both horizontal and vertical surfaces, so we can use it to lay out the dirt work and pony walls on stepped foundations. We also use it to transfer a layout from the floor to a vaulted ceiling so we don't need to snap lines on the ceiling and can spend less time on a ladder. The PLS90E is available online for about $350. plslaser.com

22. CHAPPELL SQUARE

Chappell squares are high quality, and they're packed with useful features and made in the U.S. I like the Master Framer because it's 18 by 24 inches; the extra 2 inches over a standard framing square makes a difference and the 18:24 proportion is the same as a 9:12—a slope we cut frequently. With this square, I can mark across an entire 2x12 without needing to extend the line. For working on exposed beams, a smaller square is handy, and the 9x12 Center Square from Chappell is one I can trust. The Master Framer is $125; the Center Square is $50. chappellsquare.com

Tim Uhler is lead framer for Pioneer Builders, in Port Orchard, Wash. For more photos and tools, see the slideshow at toolsofthetrade.net.

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Charging for the Estimate

How to avoid giving away a lot of free work

BY BRIAN ALTMANN

I have been in the remodeling business for almost 30 years. During the first 19 years, I did what I thought we were supposed to do: I went out on "estimates." I'd show up promptly, take notes, and ultimately acquiesce to the homeowner's demand for a dollar estimate for the job. I'd usually supply this along with a sketch and a brief project description. I would run all over town, providing as much information as I could to anyone who was interested, and then I'd wait and hope someone would call me back. Some called, but many didn't.

My entire sales and estimating process felt broken and left me feeling frustrated, used, and resentful toward the people I wanted to work for. "How dare you not call me back," I'd think, "after I worked so hard to earn your business? What about the drawing I gave you? What about the three times I visited your house? What about the trade partners I brought to your home to provide critical insight to the project?" After 20 years in the remodeling business, I decided enough is enough. I was tired of being a free estimator.

So I revamped my approach. My goal was to devise a sales system that would benefit the homeowner and enable our company to turn a good profit. It needed to enable me to thoroughly understand and appreciate exactly what must-have information the homeowners needed in order to safely sign a remodeling contract with our

Illustration: Tim Healey

company. Rather than refer to it as an estimate, I came up with the term "Comprehensive Project Evaluation" (CPE).

What I didn't know at the time I came up with this idea was that this new system would become an amazing value-building machine that would significantly increase my company's bottom line and more than double our company's closing ratio.

ESTIMATES ARE FREE ... AND WORTHLESS

I teach a course at JLC Live called "Charging for the Estimate: A Guaranteed Approach." I always ask the participants in the class why they offer estimates at no charge. The common response is always that the client expects a free estimate, and besides, all the other contractors do it.

If I called a car dealership and asked how much a car costs, they'd say, "Price ranges anywhere between $15,000 and $75,000." Doesn't the same hold true for a new kitchen? This wide range of costs is the problem with an estimate. It's meaningless if it's based on vague, hypothetical criteria.

To figure out how much a specific car costs, customers go down to the lot, test-drive a vehicle, read about the manufacturer and its reputation, and pore over the window sticker to find out exactly what they are getting for their money. Only then are they able to understand the precise investment they'll need to make for a particular vehicle. Consumers certainly wouldn't purchase a new car without all of this information. So why would they buy a kitchen, a new bathroom, or a master suite without the same amount of detailed information?

Certainly the estimates that our company delivered for the first 19 years were not comprehensive, and I never felt as if I were providing the client with the substantial information they required. But if I were to charge a professional fee for this information—and really make it a service—we could significantly up the ante and put our clients in a much better position to succeed with their remodel.

That was the goal. I decided to keep things simple at first and still offer a free estimate at the initial meeting (dubbed the "Introductory Appointment") with prospective clients. But I mean an estimate in the true sense of the word. The dictionary calls an estimate a rough, or approximate, calculation. At this point, the closest I can come up with is a price range. This is the only thing that's realistic without filling in every blank of what the project entails. Ultimately, however, homeowners need every blank filled-in and that is exactly what the CPE provides.

THE FIRST VISIT IS FREE

My Introductory Appointment with potential customers is free—it's a consultation that allows me to learn more about them and their project. It's also the time to prequalify and to make sure that their project would be a good fit for our company. We learn about the customers, and they learn about us.

But the Introductory Appointment is not an order-taking session where I jot down tons of information about projects that the homeowner would like an estimate for. Usually this is exactly what the homeowner has in mind. But at this first session, it is my job to follow a process that will be valuable to everyone.

Inevitably, when I arrive at the home, the first thing the homeowners want to do is drag me right to the cruddy old bathroom and start discussing the details. I stop them from giving me the immediate tour, and ask if there is a comfortable place for us to sit for a few minutes so I can ask some "very important questions."

At this time, I want to understand the intended time frame for the project start and finish dates. I would like to know if they are interviewing other remodeling companies. It is crucial for me to ask what qualities the homeowners are looking for in a remodeling contractor. Have they had any prior remodeling experiences and what were they like? In order to truly be of help, I also need to know what is motivating them to remodel.

By presenting a Comprehensive Project Evaluation, I am doing more than handing over a piece of paper with numbers on it. I am providing a valuable service to my customer.

During this initial discussion, I ask homeowners to give me a brief description of the project along with information about any obstacles that they see might arise. I believe it is key for the homeowners to do most of the talking during this exchange. My primary job is to take accurate notes. Once all this information is in hand, it is time for me to ask, "May I ask what you know about DBS Remodel?" This is a critical opportunity for me to build trust with the homeowners.

When given the opportunity to introduce our company, I am brief and to the point. It is all about the homeowners, not our company. My main focus is to share with them any qualities about our company that might alleviate the concerns that they just shared with me. For example, if they had a bad prior experience with a remodeler that left dust all over their house, I might share with them that our team uses Zip Walls and a BuildClean air scrubber to minimize dust. The idea here is explore any fears homeowners might have about hiring a remodeler and explain to them how our team can help. After this brief discussion, I ask for permission to see that bathroom (or whatever) they wanted to show me.

As we tour the project, I just try to get an overview and take very few notes. I am still in prequalifying mode and making sure this project would be a good fit for our company. Inevitably, this is when the homeowners ask for lots of advice on what to do.

This is when I used to be tempted to show the homeowners how smart I am, and I'd offer every idea under the sun. But hold back! It is a good time to sprinkle a few ideas to let them appreciate your years of experience, but keep the real information in check until you understand enough about the project to make your advice meaningful.

This is important: If the project is not of interest to me, I quickly and respectfully decline, telling the homeowners that I don't feel the project is a good fit for our company. This may be momentarily awkward, but in the long run, you've saved time for everyone. I may spend a few minutes advising them on hiring another remodeler and on what to look for.

But if I think that the project *is* a good fit for our company, then it's time to get back to the table and become the owner's paid consultant.

As we sit back down at the table, the first thing I discuss is the budget. Most of the time when I ask homeowners if they have a budget, they say no. But when I hint that a new bath could be a $30,000 investment, they chime right in. This is the time that I offer the "free estimate." I use my professional experience to offer them a budget range. I may say, "We do 20 to 30 bathrooms a year that would be very similar to yours and the typical budget is between $20,000 and $30,000."

Is it possible for me to give them anything more accurate than that during our introductory appointment? No. Beyond having decided that they might want to remodel their bathroom, most homeowners are not even sure what they specifically want at this point.

In the past, I would have spent hours and hours working with them for free to give them all of the knowledge and information that has taken our company years to develop. But here is where the game has changed: By presenting a Comprehensive Project Evaluation, I am doing more than handing over a piece of paper with numbers on it. I am providing a valuable service to the customer. That's how I present it to them, and it's what allows me to unflinchingly ask to be compensated for the effort.

IT'S NOT AN ESTIMATE; IT'S A CPE

The CPE is comprised of three vital parts: Design, Job Scope, and Cost Analysis. It is my belief that every homeowner needs all three of these components in order to conduct business with a remodeling company.

To illustrate how I go about asking to be compensated for the effort of putting this all together, let's get back to that first meeting: At the conclusion of discussing the budget, I proceed to share my opinion on the value of these three components and the necessity for a consumer to understand and acquire them.

The conversation sounds something like this: "Mrs. Jones, the bathroom project that you have shown me would be a perfect fit for our company and I would be interested in working with you and your family. DBS Remodel has a well-thought-out process that can help you navigate through this bath project. I believe there are three things that anyone in your position needs in order to safely sign a contract with a remodeler.

"The first thing that we need to create is a Design for your new bath. We talked about relocating the door to the bedroom. We also talked about creating a half wall at the shower to let in more light. Having a drawing to represent all of this will give you a much better image of the proposed project." (There are many projects that need very little design, and if that is the case, we still engage in the CPE and deliver a Job Scope and Cost Analysis).

"The second bit of information that is vital to you is a thorough, detailed Job Scope. The idea here is to have you, as the consumer, understand everything that you are getting for your money. In addition, it is important to understand everything that is *not* included. All tasks, materials and trade services must be spelled out and all ambiguity erased. The Job Scope is the backbone to the contract and is designed to protect everyone involved.

"The third item that we need, Mrs. Jones, is a Cost Analysis.

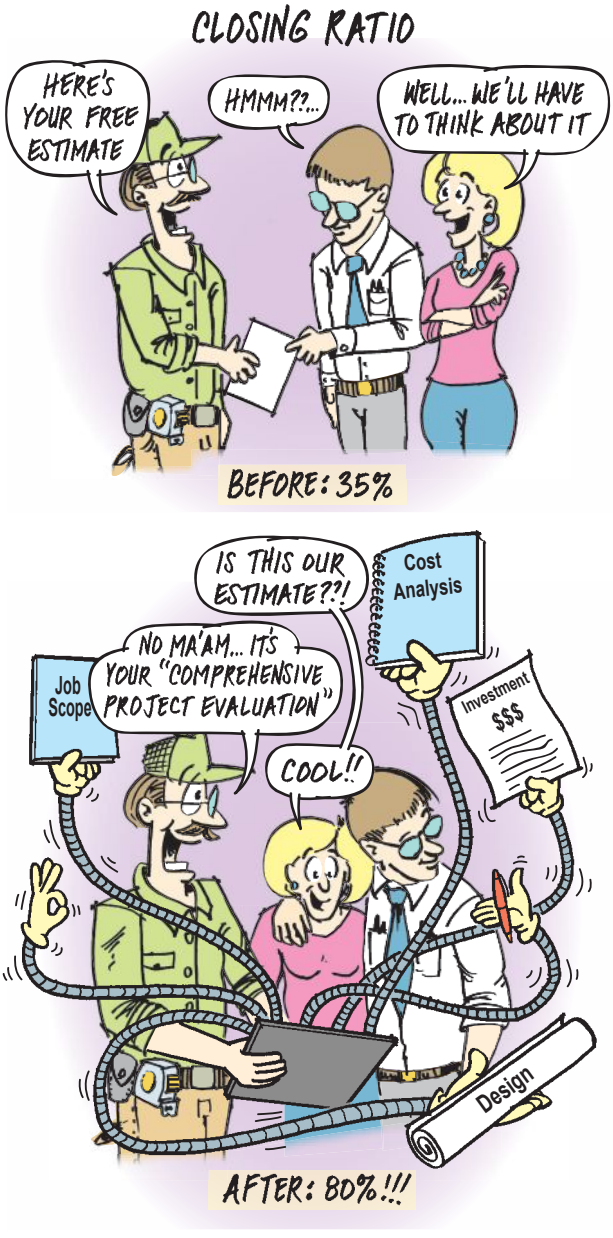


Illustration: Tim Healey

A Comprehensive Project Evaluation (CPE) includes design drawings, a detailed job scope, photos of the exisiting structure, and a cost analysis. When presenting this to the clients, the author withholds the final cost of the project until the clients understand all the services that his company, DBS Remodel, will provide. While this investment amount is derived from a careful estimate of every task and labor hour, it is presented as simply as possible as a lump sum.

Based on existing conditions, our new Design, and the detailed Job Scope, we will accurately assess what your investment will be for the proposed project. This is not ballpark pricing, but an accurate project cost based on specific criteria. With estimates from different contractors, there seems to be a tremendous amount of gray area. We eliminate this uncertainty and any surprises that may follow.

"The Design, Job Scope, and Cost Analysis are all part of a professional service, called a Comprehensive Project Evaluation (CPE), that our company offers. During this process, we will leave no stone unturned and we will firmly put you in the driver's seat with your project."

At this point I show the homeowners our CPE Agreement Form and review its content. I have purposefully kept this agreement simple so it's easily understood. It includes a description of the project, a list of the type of drawings we will be delivering (floor plan, elevations, and the like, and it specifies that revisions are allowed), and a statement that mentions the fee for this service, which will be applied toward the cost of the project. At this point, it is important to explain that the project investment will be presented in lump-sum fashion, rather than a detailed breakdown of costs by task, which can be confusing for homeowners. Furthermore, I explain that if we are not hired for the project, the homeowners retain the rights to all documents; however, if they choose to work with another company, then we are relieved of any liability associated with the project.

I always have several examples of Design and Job Scopes relative to their project type on hand. If clients are looking for a new screen porch, I show them Designs for porches that we have done along with a detailed Job Scope. It is more than likely that the clients are not receiving this level of detail from others (probably because the others are not being paid) and the clients are quick to recognize the benefit. I hope to sign this agreement at the end of our first visit and receive payment for the CPE in full at this time.

Service fee. To calculate how much to charge for the CPE, I estimate how many hours the entire process will take, largely based on experience (typical kitchens, bathrooms, basements, porches, and so on take two to three visits), and multiply that by what I feel my services are worth per hour (typically, $150 per hour). If we hire an architect for some design services, then I mark that up accordingly and add that in.

The CPE service fee can range from $200 for a deck or half bath to $4,000 for an addition. On average, CPEs for bathrooms range from $200 to $800 and kitchens range from $400 to $1,700. It comes down to the simplicity or complexity of the project. When I first started to offer this service, I probably charged 50% of what I do now. Once you thoroughly believe in the value of the service, it gets easier to ask to be compensated fairly.

If I am awarded the project, then I deduct my job scoping and estimating costs from the project. I still must include costs for outside design and build these into the contract. I would recommend starting with a very low investment for this service and raise your costs when you are comfortable with the system.

There have been times when clients balked at paying for an estimate when they have already gotten three others for free. I tell them again that a Comprehensive Project Evaluation is very different from an estimate. Then, I'll ask if I can look at their estimates, and I usually get the same response: "I am still waiting for two of them, and the other was a quote over the phone." Generally, if a

homeowner insists that you have no business charging for your time, that tells you all that you need to know about them.

CPE PART 1: DESIGN

With a signed CPE agreement in hand, it's time to get started with Design, and the first decision is who will do this work. For additions and major renovations, we subcontract to a professional designer who is also a licensed architect. For our kitchen projects, we use the retail company that we purchase our cabinets from (they offer us this professional design service free of charge). All projects such as bathrooms, lower levels, porches, decks, and the like, we design in-house using Chief Architect as a design presentation software.

Next, I capture digital images of the entire work area to share with the Design team. These images will also be used to develop the Cost Analysis.

If the project requires design assistance from my architect, then we schedule our next appointment. Prior to this next meeting, I share some thoughts with my architect regarding the homeowners' intentions and budget range. During this first Design meeting (at the clients' home), my role is to facilitate the discussion and make sure the architect and the homeowners are communicating effectively with each other.

At an agreed upon later date, we return to review the drawings and make necessary changes. When this process is complete, we have the homeowner sign off on the drawings, and we start the Job Scoping phase.

With a kitchen remodel, I create an informational packet for our showroom kitchen designer. Included in this packet are digital photos of the kitchen space and a detailed, hand-drawn floor plan with all required measurements. I also interview the clients to learn what they like and don't like about their existing kitchen—crucial information to pass along to the designer.

Once I've dropped an information packet off and reviewed it with the kitchen designer, we are ready for the clients to visit the showroom. Again, at completion of Design, we have the clients sign off before moving forward with the Job Scope.

For all other project types, I start the in-house design process immediately after signing the CPE. For this process, we rely on client suggestions, our job portfolio, Houzz, and my experience.

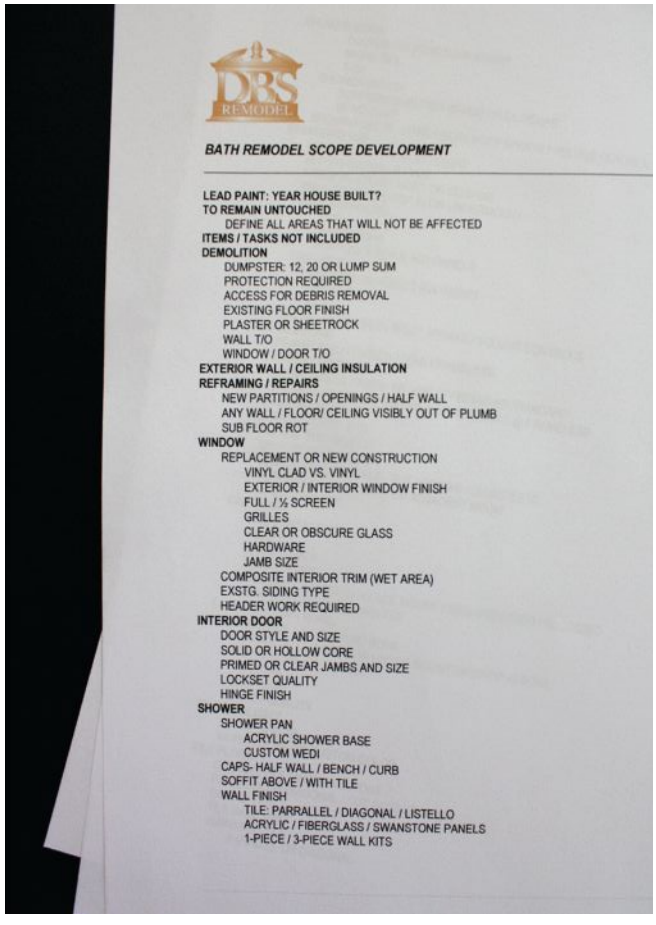
CPE PART 2: JOB SCOPE

The Job Scope is perhaps the most critical document. It not only tells what the client will purchase, but also what they won't. When developing this document, I like to play the role of a lawyer —for my client as well as for DBS Remodel.

In order to complete the Job Scope, I may need to interview the client a time or two more. I use detailed questionnaire sheets that we have developed that are specific to each project type. Here is where it is critical to be thorough. If it's a tile job, we ask questions like: What is the purchase cost of the tile? Was tax included? Are we setting the tile over Ditra? Are we using Grout Once sealer? The Job Scope needs to mention how we will protect the home and clean the home and address debris removal, permits, portable toilets, and so on. There are many items to list and each one will help create excellent communication about the job at hand. Effective job scoping prevents clients from pushing you around, and from their assuming things were included that weren't. Many homeowners want things for free, but an iron-clad Job Scope will prevent this.

I have found an allowance system to be helpful to expedite the process. For example, rather than ask Mrs. Jones to pick out the medicine cabinet before signing the contract, I simply identify whether or not it is recessed or surface mount (a difference in labor) and insert a dollar-value purchase allowance for this item (specifying whether tax is included). But before setting an allowance, we have a discussion with the clients about their taste, as the price of a medicine cabinet can vary from $300 to $3,000.

I review all Job Scopes with clients line by line. The story is crafted in chronological order to assist the clients in understanding and grasping the information. Some of this may be boring to them, but



To develop a complete Job Scope, the author works from detailed questionnaires when interviewing clients. A complete scope, however, may take more than one interview and multiple site visits.

At every meeting, the author presents any prepared documents he wants to leave with the clients in a presentation folder. It's one of the marketing tools that becomes an important part of a sales and estimating process based on providing a CPE instead of an "estimate."

I always say, "You invested money in me so that I can educate you and I do not want to disappoint!"

As we review the Job Scope, I look to see how well the clients understand all the details of the Job Scope. As we sort these out, we make corrections on the spot. Sometimes the homeowners want to change something. Or, we may need a better look at some portion of the project, and can do this now that we are back in the home. The key here is to make all necessary changes and get it right. Oftentimes a fully developed Scope will take two to three meetings before it is accurate. I always make changes in a different color font so we can focus on the changes at subsequent meetings and not drag through the whole scope each time.

The process of reviewing the Job Scope usually builds trust, which has tremendous value. We are sharing things with the homeowner that no other remodeling firm is and we are getting paid to do so. We can afford to be focused and patient. This is not easy to do when you are not compensated, and especially when you are not sure that the people you are talking to may ever even call you back.

CPE PART 3: COST ANALYSIS

I never calculate a Cost Analysis until the Job Scope is complete. Too many times I think I am ready to dive into my estimating software when all of the sudden the homeowner does a 180-degree turn on the Scope. Patience is key.

I use Timberline software and do all of the behind-the-scenes estimating by task and labor hour. I do nothing by the square foot or unit cost. As with most companies, I am trying to earn a 12% to 14% net profit. And while I have analyzed the Scope by task and labor hour, I keep all this detail to myself and present the proposed budget as a lump-sum figure, as I mentioned earlier. A detailed break-down can be confusing to customers, and the last thing I want is the clients niggling over tiny cost details that they might not fully understand. They will understand the bottom line, however. This is what they want and this is what I give them once they have a complete understanding of the full value of their investment.

CLOSING THE DEAL

During each client visit, I always bring my prepared documents in a DBS Remodel presentation folder. At the first visit, I give one of these to the clients to keep all their documents organized. As I am closing the deal, we review the amended Scope for the last time. Any change from here on out will be executed through a change order.

I never include the investment figure on the scope document. Ultimately, everyone goes to the last page looking for it. I tell them it's not there because I want them to focus on understanding what they are purchasing first. When all questions have been answered, and they understand what they're buying, I unveil the projected cost for the project.

By this time most homeowners have ruled out their other options. No one else has been as thorough or nearly as professional. My closing ratio without a CPE used to be around 35%. When I engaged in the CPE process, my closing ratio climbed to around 80%. Truly, the process is a value building machine that is beneficial to all.

Brian Altmann, CAPS, is president of DBS Remodel, a full-service residential remodeling company based in Poughkeepsie, N.Y.

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BY LAUREN HUNTER

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1. A Bonding Moment

To quickly and securely bond together a variety of building materials, including nonporous substrates, use Titebond Fast Set polyurethane construction adhesive. According to the manufacturer, the one-part adhesive develops strength rapidly, even in adverse conditions such as near-freezing temperatures, and it bonds wet and frozen materials. For indoor use, Fast Set's low VOC content complies with several green-building programs. Fast Set is available in 10-ounce cartridges for about $5 and 28-ounce cartridges for about $8. titebond.com

2. Digital Water Heating

Rheem's EcoNet is an automation system that is now compatible with the company's Prestige Series hybrid heat-pump water heaters in addition to many of its other HVAC products. A WiFi-enabled module allows users to adjust temperatures, program the thermostat, and manage alerts through an app. The mobile version syncs with the home's thermostat so both are always up-to-date. EcoNet can also be integrated into many home automation systems. rheem.com

3. Coastal Style

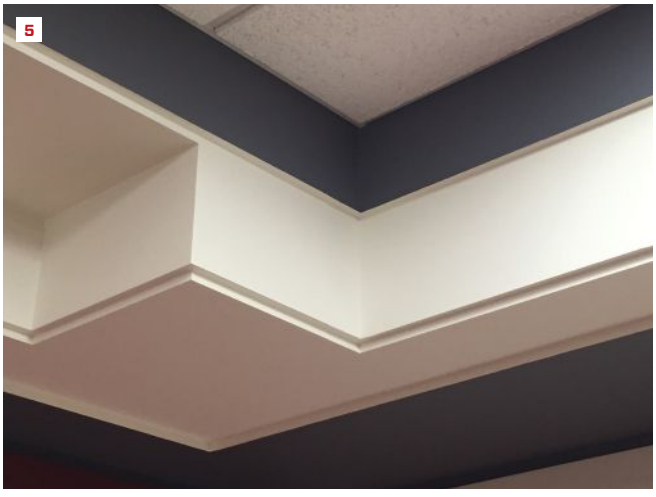
Philippe Starck's Cape Cod collection for Duravit blends a variety of materials to create bathroom furniture. Vanity countertop options include vintage oak, American walnut, European oak, white beech, or high-gloss white, paired with a chrome frame and topped with round, square, or tri-oval washbasins. The basins, available on their own, are crafted from Duravit's DuraCeram, which allows for rims as thin as 1/5 inch that still have high impact resistance. The Cape Cod collection also includes bathtubs and mirrors. duravit.us

4. Warm, Insulated Floors

ThermalStar Radiant Comfort panels from Atlas EPS provide insulation as well as an easy way to install under-floor hydronic heat for both new construction and retrofits. These expanded polystyrene panels have grooves that hold the hydronic tubing without the need for fasteners. New-construction panels install under radiant slabs, while retrofit panels are thinner and install between the subfloor and finished flooring. Panels come with a limited lifetime warranty for physical and thermal performance. thermalstarradiantcomfort.com

5. Sharp Corners

The new Reveal Corner Bead from Trim-Tex lets designers add modern detailing with crisp, clean corners. The vinyl profile incorporates a 90-degree outside corner reveal that can be used with 1/2-inch or 5/8-inch drywall, creating the look of layered drywall without the added work or material. A creative alternative to traditional metal or plastic drywall corner bead, Reveal Corner Bead is easy to install and can be cut on a miter saw for two-way or three-way intersections of drywall surfaces. Pricing will vary by region. Samples are available. trim-tex.com



6. The Bronze Age

A Sunset Bronze finish has been added to Whirlpool's Ice White and Ice Black collections, giving homeowners an alternative to the more-traditional stainless appliance look. The warm tone is actually a painted stainless steel that blends gold, copper, and bronze, allowing the appliances to complement a wide range of kitchen finishes. Sunset Bronze is also fingerprint-resistant in everyday use. It's coming in the fall of 2015, and pricing is still being determined. whirlpool.com

7. Granted Re-entry

Homeowners no longer need to wait for days to reoccupy a home that has gotten an insulation upgrade. Icynene has announced that its Classic Max light-density open-cell and ProSeal medium-density closed-cell foam insulation now have four-hour reoccupancy allowances for homeowners and trades. Refinements to the low-VOC formulations allowed the manufacturer to lower the exposure risks and reduce the reoccupancy wait by more than 80%. The new four-hour time frame for Classic Max and ProSeal is based on an active ventilation rate of 40 air changes per hour (ACH). icynene.com

8. On the Boardwalk

Three additions to the Architectural Remnants laminate collection take their cue from the coast. To the Sea, Seaside Pine, and Surf Side recall fishing-shack clapboards, vintage seaside porches, and weathered boat timbers. Laminates in the collection measure 12mm thick and feature a commercially-rated wear layer to protect against staining, fading, and wear-through. A "HydraCore Plus" layer gives the material the feel of solid wood, according to Armstrong, and helps dampen the hollow sound of thinner laminates. Pricing ranges from $3 to $4 per square foot, uninstalled. armstrong.com

9. Window Introduction

Siteline is Jeld-Wen's newest product line, positioned as an affordably priced, mid-tier wood and clad-wood window and patio-door collection. Siteline boasts large window sizes and improved thermal performance with LoE3-366 glazing that meets 2016 Energy Star 6 requirements. Siteline windows and doors feature AuraLast wood protection that comes with a limited lifetime warranty against wood decay and termite damage. Choose from a wide variety of interior and exterior finishes, along with eight hardware finishes. Check with your dealer for pricing information. jeld-wen.com

10. Wall-Washing Light Fixture

Nora Lighting has added an adjustable LED downlight with a 5-inch aperture to its Diamond II Retrofit Series of recessed LED fixtures. An adjustable gimbal rotates 356 degrees and the angle adjusts from 0 to 40 degrees, allowing the fixture to provide wall-washing effects as well as accent lighting in sloped ceiling applications. Diamond Series retrofit units work with a variety of dimmers and are rated for use in damp locations. Models are available in a range of finishes and in three trim packages, including surface adjustable, regressed baffle, and regressed reflector. noralighting.com

11. Sleek Safety Eyewear

Uvex Livewire sealed safety eyewear now features the company's Hydroshield anti-fog lens coating. The coating lasts 60 times longer than competitive products, so workers who need the protection of goggles in high-particulate environments can have fog-free visibility for longer periods. The coating also offers improved scratch resistance. Livewire eyewear with HydroShield comes in nine tints and two frame colors and can accept safety frames for workers who wear glasses. uvex.us

12. Solar Rack for Tile Roofs

Solar installers can form the QBase Universal Tile Mount to fit virtually any roof tile, flat or curved, according to QuickMount PV. The QBase has a strong, cast-aluminum foundation with four gussets to support stand-off posts for tile from 4½ inches to 7 inches wide, on either retrofit or new roof installations. The double-flashed mount features a spun-aluminum cone with no seam to fail in the face of extreme weather. All of the QBase's exposed hardware is 18/8 stainless steel and will work with all leading solar panel racks. quickmountpv.com

Compact Framing Nailer

BY DOUG MAHONEY

Framing guns are big and heavy tools—or so I thought. Then I had the chance to test Paslode's new F325R Compact Framing Nailer. It's nothing at all like my old framing guns; in fact, it's actually smaller than some of my finish guns. I've found it to be a great tool to have on hand, especially for remodeling work.

SMALL IS BEAUTIFUL

As framing guns go, the F325R is small—really small. And at just under 6 pounds, it's a good 2 pounds lighter than the average stick framer (my old Bostitch gun weighs more than 8 pounds). According to Paslode, much of this weight reduction is because the body is made out of magnesium instead of the usual aluminum.

The reduced weight is nice, but what I really like about this gun is the size. At less than 13 inches long, it fits in a stud bay with room to spare, and the short nail magazine makes it more maneuverable in corners and closets where clearances are tight. When I'm working, the smaller magazine doesn't get hooked on the air hose like the larger ones do.

Power. I was happy to learn that the size reduction doesn't cause any loss of power. I knew I'd have no problem nailing regular 2-by stock, but the gun performed just as well when I worked with LVLs and pressure-treated lumber. As a test, I even unloaded about 20 nails in fast sequence into a PT 6x6 and every nail went in below the surface of the wood.

Nail capacity. The only real sacrifice for this compact size is nail capacity. Regular paper-tape guns traditionally hold three racks of nails, but the Paslode holds only one, amounting to about 40 nails at a time. On a framing crew, that isn't going to last long, but if you spend your time boxing out for medicine cabinets and reframing door openings, the reloading isn't as constant, and I never thought of it as a nuisance. I'll still keep the larger gun for production work, but for most daily tasks, I'll stick with the new Paslode.

The F325R has a couple of other features that I like. The large rafter hook works great and can be switched to the other side of the tool with just a hex key; it's big and deep enough to be hung from a 2-by rafter without any problem.

The nose of the gun is similar to other Paslode nailers I've used, with an aggressive claw and a large "glove-friendly" depth-of-drive adjustment. I also like how the rubber overmold on the handle extends up and forms a ring around the body of the tool. This serves as protection when the gun is placed on a finished surface.

NIGGLING DETAILS

I have only a couple of complaints about the tool, and they are incredibly minor.

First, like all Paslode guns, the F325R does not come with an attached air-hose coupler. I understand there are a lot of people who use different size connections, but it seems like every other manufacturer supplies a standard ¼-inch male coupling with its tool.

It's a small point, but whenever I get a Paslode gun, I end up needing to pillage the connector off another air tool until I can go back to the hardware store to get a new one.

The other small issue is the toggle between sequential- and bump-fire modes. To make the switch requires repositioning the angle of the trigger, and in order to do that, you first need to remove a nearly microscopic O-ring that holds the trigger in place. The only way I've found to do it is with the point

Photo: top right, Doug Mahoney

of a utility knife, which is risky, to say the least. And once this O-ring is released from the tool, it can be easily lost on a construction site. Basically, if you drop it, you've lost it.

I tend to keep my framing guns on sequential fire for safety reasons, but it would be nice to be able to quickly toggle back and forth if I needed it. I've used plenty of other guns that can make the switch with a little button or a toggle, and it's a mystery why Paslode hasn't done something similar.

BOTTOM LINE

The downsides to this framing nailer are slight, however. If Paslode's mission was to create a light, manageable, easy-to-use framing gun, it has definitely succeeded. Since I'm not a framer, I'll happily take the smaller nail capacity in exchange for a lighter tool that's easier to use and less of a workout on my arm.

Paslode F325R Compact Framing Nailer Specs

Dimensions (HxWxL): 12.9 inches by 4.3 inches by 12.3 inches
Weight (w/o air fitting): 5 pounds 15 ounces
Fasteners: 30-degree; paper collated
Fastener diameter: .113 to .131 inch
Fastener length: 2 to 3 ¼ inches
Magazine: holds one strip (up to 44 nails)
Features: simple reversible rafter hook; dry fire lockout; adjustable depth-of-drive
Operating pressure: 90 to 120 psi
Country of origin: Assembled in the U.S.A. with foreign and domestic components
Suggested pricing: $270

Doug Mahoney is a carpenter in Harvard, Mass., and a regular contributor to Tools of the Trade, *where this review originally appeared.*

Innovative Edge Clamps

BY DAVID FRANE

Rockler sent me a pair of Bandy Clamps when the company announced the product in March. As soon as I saw the packaging, I knew what the tools were about; they're intended to clamp solid edging against the edges of plywood—though they can also be used for almost any task where it's necessary to squeeze something against the edge of a piece.

The clamps are spring clamps with a wide rubber strip spanning the jaws. Using them is a matter of squeezing the grips, pressing the band against the edge you want clamped, and releasing the grips so the pads grasp the piece. If the band is stretched, it will apply constant pressure to the piece being held. These clamps will easily hold straight edging in place, and I've used them to hold ⅛-inch wood edging against a concave edge. They did the job, though I wish I'd had more than two of them to work with.

The clamps are solid but light. A steel spring holds the composite body of the clamp closed until you squeeze the rubberized handles. The pivoting jaws are covered with substantial rubber pads and will open far enough to clamp 8/4 stock. The spring is stiff and the clamp grabs very well. Because the band is rubber, it will automatically conform to irregular pieces.

Bandy Clamps are a good alternative to placing a caul against the edge piece and spanning the substrate with bar clamps; it's faster and there are fewer items to handle. I like these clamps better than the three-way edging clamps I once used for this task, because neither the jaws nor the band will mar the piece. The band can't press as hard as a screw-style clamp, but it is able to supply enough clamping force provided the edge piece is not so thick and bowed it needs to be forced into position.

The Bandy Clamps are not just for clamping pieces that are being glued; I've used them to hold edging in position while fastening it with 23-gauge brads. Yes, I could have relied entirely on glue, but 23-gauge pins are so small that it's hard to see the entrance holes.

I've also used the clamps to secure hoses, cords, and camera tripods while shooting video in the shop—each clamp is like a handy third hand.

It's worth noting that if you plan to use these clamps for more than minor repairs, you're going to need more than two of them. If you plan to do much edge-gluing, six clamps would the minimum. I'd want 12.

Bandy Clamp Specs

Maximum opening: 2 inches
Jaw depth: 1 ⅝ inches
Price: $20 for one pair; $50 for three pairs
Country of origin: China

David Frane is the editor of Tools of the Trade.

remodeling

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Top-of-Class Cordless Hammer Drill

BY MICHAEL SPRINGER

For those who keep only one drill/driver on hand, a full-sized 18-volt cordless hammer drill can be a good option. You may not need the hammer function all the time, but it's helpful to have the capability of drilling into dense materials such as steel, concrete, and masonry when you need to.

I recently tested 10 different 18-volt models for *Tools of the Trade.* With all of them, users can switch between three modes: drilling, clutch-controlled driving, and hammer drilling. While all of those tools are capable of everyday drilling tasks, I was looking for the heavy hitters—those with the muscle to handle the jobs that often come up for remodelers, but that smaller drill/drivers just can't do.

I put each of the drill/drivers through a series of tests to evaluate overall speed and power, measuring the average time in seconds to drill holes through 2-by Douglas fir with a 1-inch auger bit and with a 2 9/16-inch self-feeding bit, and through a 6-inch Douglas fir beam with a 7/8-inch auger bit. I also measured how many 1-inch holes through 2-by Douglas fir I could drill before depleting the battery, to evaluate runtime.

PERFORMANCE

The tool that showed the best pedal-to-the-metal horsepower was Makita's new XPH07T. Among the 10 18-volt models I tested, the Makita dominated the field by posting the fastest times in every power challenge of the test, as well as topping the runtime ratings. Winning all of the time trials showed that it had power to spare and could perform the same work faster than the other tools.

The complete details on the test, as well as the outcomes from the other nine contenders, can be found in the slideshow "18-Volt Cordless Hammer Drill/Drivers," at toolsofthetrade.net. Next in line after the Makita came the tools from DeWalt, Metabo, and Milwaukee. These models kept a strong pace through the toughest work and also were at the top of the runtime ratings. Festool and Hilti ranked next. They could perform most of the heavy lifting, but their four- and three-speed gearboxes (respectively) meant that their low-gear application speeds were slower than those of the most capable tools.

PROS AND CONS

The Makita has a couple of nice features: a belt hook that mounts on either side and an extra-long side handle that maximizes leverage for resisting big bits. The side handle attaches without sliding over the bit and chuck.

On the downside, clutch settings are too weak for driving larger fasteners, so the tool must be used in drill mode, which can overdrive fasteners or subject users to high reaction torque since the tool is so strong. As with other Makita batteries marked with a star logo, the new 5.0-Ah pack will shut down when the tool is overloaded and require a full check-up charge—even if it is fully charged. This can slow you way down, so avoid repeatedly pulling the trigger once the tool stalls.

Overall, however, the Makita is a standout brushless-motor tool. It mastered every challenge, posted the fastest times in every trial, and set the bar for 18-volt cordless hammer drill/driver power.

Makita XPH07T Specs

Battery: 18 volts; 5.0 Ah
Battery gauge: Three bars; on tool
Weight (pounds): 5.35; with handle, 6.03
Rpm: 0 to 550; 0 to 2,100
Hammer Bpm: 0 to 8,250; 0 to 31,500
Features: Brushless motor; double LED headlights; 14 5/8-inch side handle; stop rod; belt hook; onboard bit holder
Price: Kit, $350; bare tool, $150
Includes: Tool; two batteries; charger; large plastic case
Country of origin: Tool, China; battery, Korea and Vietnam
Notes: Also available in a kit with 4.0-Ah battery packs (XPH07M)

Michael Springer is a remodeling contractor in Boulder, Colo., and a frequent contributor to JLC and Tools of the Trade, where a version of this article first appeared.

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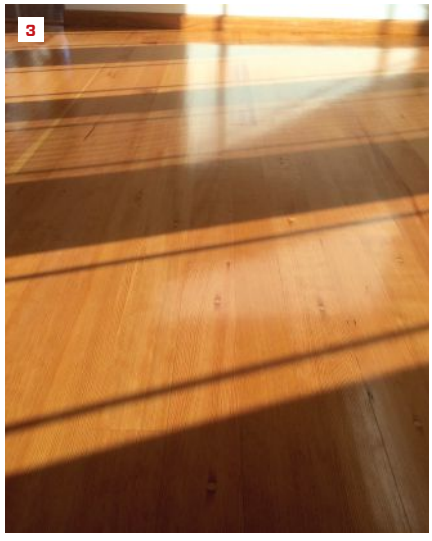
Classifieds

BY JON VARA

1. Bolt holes in recycled bleacher boards are carefully filled with matching plugs.

2. The prepared stock is then run through a surface planer.

3. The resulting clear, fine-grained material is ideal for cabinet work, high-end interior trim, or flooring.



Indoor Old Growth

The best flooring and millwork have always been made from straight-grained old-growth lumber. But now that the big trees are gone, millwork shops need to take their old growth where they find it.

Mark Anderson, the proprietor of Trevett Millworks, in Greenwich, N.Y., finds his in old gymnasium seating. When an area gym is slated for renovation—which often involves tearing out half-century-old wooden bleachers and replacing them with modern self-retracting plastic seating—Anderson will send an eight- or a 10-man crew to the site to salvage the lumber and haul away the steel for scrap.

Bleacher boards, he reports, range from ¾ inch to about 1½ inches thick and are up to 11¼ inches wide and as much as 22 feet in length. The majority are sawn from clear yellow pine or Douglas fir. On rare occasions, striped mahogany seating from the 1920s or 1930s will turn up.

Whatever the species, Anderson says, it's wonderful stuff to work with. Because bleacher seats are fastened with easily removed carriage bolts, they're less likely to contain machinery-damaging nails or screws than recycled beams or timbers.

On the other hand, the crew spends a lot of time scraping off generations-old accumulations of chewing gum. "It's amazing," says Anderson. "There's so much of it you'd think they encourage chewing gum in school."

Jon Vara is a writer in Cabot, Vt.

Photos: Carl Anderson

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